reference

GUIDE•

version 1.1

METROPOLIS

mTropolis Reference Guide

mFactory, Inc.
1440 Chapin Avenue, Suite 200
Burlingame, CA 94010
USA
E-mail: info@mfactory.com
World Wide Web: http://www.mfactory.com

Contents

Chapter 3. Edit Menu

Chapter 4. Format Menu

Chapter 5. Arrange Menu

Chapter 6. Object Menu

Chapter 7. View Menu

Chapter 8. Structure Window

Chapter 9. Layout Window

Chapter 10. Layers Window

Chapter 11. Palette Reference

Chapter 12. Modifier Reference

Chapter 13. Modifier Pop-Up Menus and Message Reference

Chapter 14. Miniscript Modifier

Chapter 15. Attributes

Chapter 16. Glossary

Appendix A. MovieTrax

Chapter 1. Getting Started

mFactory's mTropolis™ is a development system for authoring multimedia titles and applications. Sophisticated features such as message passing and reusability of components are built into the environment, offering the author new creative possibilities and significant productivity advantages.

mTropolis' object technology is presented in a graphical authoring environment. This approach changes the focus to the media and logic of the title, rather than its low-level code. All creative work is done visually, without intricate and time-consuming programming. mTropolis provides facilities for creating components, linking them to media and altering these components with tools and modifiers. An organizational structure is built into the environment, providing a simple framework for managing components within the title. Although complete titles can be created with the basic package, additional software components for specialized titles can be purchased from mFactory or third parties. mFactory also offers an Application Program Interface (API) called mFactory Object Model (MOM™) for multimedia programmers who want to extend the power of mTropolis by writing their own modifiers using programming languages such as C or C++.

For an overview of the authoring process and a hands-on introduction to mTropolis, including a step-by-step tutorial and sample projects, consult the *mTropolis Developer Guide*.

The rest of this chapter outlines platform requirements, mTropolis installation instructions and the structure of this reference manual.

EQUIPMENT AND MEMORY REQUIRED

The minimum configuration recommended for authoring in mTropolis is a 68040 or Power Macintosh with:

- 6 MB application RAM (for 8-bit color) or 8MB application RAM (for 24-bit color)
- System 7.x
- QuickTime 2.5 (included on the mTropolis CD-ROM)
- Sound Manager 3.2 (included on the mTropolis CD-ROM)

INSTALLATION

To install the mTropolis editor and player on Macintosh, follow the instructions in the "Read Me First!" file on the mTropolis CD-ROM. Don't forget to complete your registration card and mail it to mFactory.

Installing the Windows Runtime Player

To install the mTropolis player on Windows, follow the instructions in the README.WRI file on the mTropolis CD-ROM.

Release Notes

Check the mTropolis release notes in the "Read Me First!" file for late-breaking information about features in this release.

STARTING mTROPOLIS

To start mTropolis, double-click the mTropolis icon. The first time mTropolis is started, it asks for your name, organization, and registration number.

A network copy protection feature prohibits multiple copies of mTropolis with the same registration number from running simultaneously. At regular intervals, mTropolis checks to see if another copy with the same registration number is running. If another copy is detected, an alert appears and mTropolis quits. If the project being worked on contains unsaved changes, mTropolis displays a prompt asking if you want to save the changes before quitting.

DOCUMENTATION ROADMAP

Because mTropolis is an interactive tool, instructional material is provided in both traditional print and an interactive format. The mTropolis documentation set consists of the following components.

mTropolis Quick Reference
This eight page guide contains lists of keyboard shortcuts, Miniscript commands, element attributes, and pictures of mTropolis palettes.

mTropolis Developer Guide
This guide introduces basic mTropolis concepts and object-oriented programming. It also contains both simple and in-depth tutorials, and descriptions of mTropolis authoring examples.

mTropolis Reference Guide
This guide contains detailed descriptions of everything you want to know about mTropolis functionality.

Learning mTropolis Project
Use this mTropolis project to learn about multimedia basics, view simple projects, and see authoring walkthroughs. The "Learning mTropolis" project can be found in the "Documentation" folder on the mTropolis CD-ROM.

QuickStart Tutorial
Complete this simple tutorial to orient yourself to the mTropolis environment. Refer to Chapter 7, "QuickStart Tutorial—A Simple Slideshow" in the *mTropolis Developer Guide*.

In-Depth Tutorial
Complete this advanced tutorial to fully familiarize yourself with the mTropolis environment. Refer to Chapter 8, "In-Depth Tutorial—mPuzzle" in the *mTropolis Developer Guide*.

MOM Reference Guide
Would you like to customize the mTropolis environment? Learn about the mFactory Object Model using the *MOM Reference Guide*. Refer to the "About MOM" document in the

"mFactory Object Model" folder on the mTropolis CD-ROM for more information.

Exploring mTropolis

mTropolis' instructional material provides various levels of guidance. The following sections suggest paths through the instructional material, depending on the level of guidance you would like.

Lots of Guidance

- Read Chapter 2, "mTropolis Interface", Chapter 3, "Object-Oriented Design", Chapter 4, "mTropolis Basics", Chapter 5, "mTropolis Components" and Chapter 6, "Messaging" in the *mTropolis Developer Guide*. Time: about 1 hour.
- Complete the tutorial in Chapter 7, "QuickStart Tutorial—A Simple Slideshow" in the *mTropolis Developer Guide*. Time: about 30 minutes.
- View the "Authoring Walkthroughs" in the "Learning mTropolis" project, found in the Documentation folder of the mTropolis CD-ROM. Time: 30 minutes.

Less Guidance

- Complete the tutorial in Chapter 8, "In-Depth Tutorial—mPuzzle" in the *mTropolis Developer Guide*. Time: 4-6 hours.

  It is recommended to complete the tutorial in segments, rather than in a single sitting.
- Look at "Modifier Examples" in the "Learning mTropolis" project, found in the Documentation folder of the mTropolis CD-ROM. Time: 1 to 2 hours.

  Read the "Modifier Reference" in the mTropolis Reference Guide for information on any specific modifier.
- Look at "Multimedia Basics" in the "Learning mTropolis" project. Time: about 1 hour.
- Look at "Authoring Examples" in the "Learning mTropolis" project, and read Chapter 9, "Learning mTropolis Project" in the *mTropolis Developer Guide*. Time: about 1 hour.

As You Need It

- Refer to the *mTropolis Reference Guide* as you need information about different aspects of mTropolis, including menus, views, palettes, modifiers, messages and commands, Miniscript, attributes, and MovieTrax.
- Read the "About MOM" document in the "mFactory Object Model" folder on the mTropolis CD-ROM for information about accessing MOM documentation and examples.

CONVENTIONS USED IN THIS MANUAL

Illustrations have been included to help you find specific information quickly.

Step-by-step instructions are shown as bullet text. For example:

- Choose **Open** from the File menu.
- Select the graphic tool in the tool palette.

The names of menu items, buttons, check boxes and radio buttons are capitalized and set in bold type. For example:

- …the **Duplicate** menu item…
- …the **Cancel** button…

The names of messages, dialogs and interface fields are capitalized. For example:

- …the Modifier's Name field…
- …the Element Info dialog…

The names of commands are capitalized and italicized. For example:

- …sends a *Play Forward* command.

For keyboard shortcuts, the command key is written as "⌘".

Hot Tip

The name mTropolis is pronounced like the word "metropolis". The name mFactory is pronounced "em factory".

Chapter 2. File Menu

The File menu provides options for:

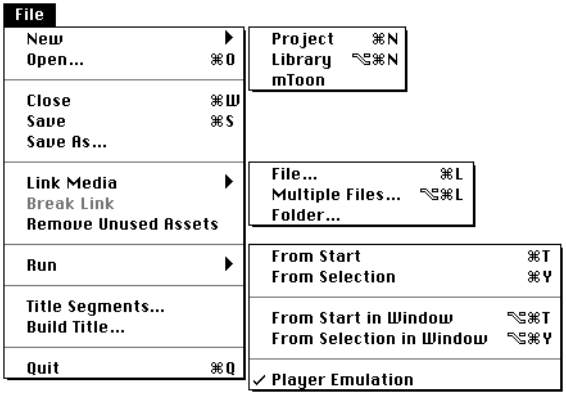
- creating, opening, closing and saving projects
- creating and opening libraries
- creating, opening, closing and saving mToons
- linking external media to projects
- breaking links to external media
- switching projects from edit mode to runtime mode
- building titles
- quitting mTropolis.

NEW, OPEN, SAVE, AND CLOSE FOR PROJECTS

Titles created with the mTropolis authoring environment are referred to as *projects* during the development phase.

When mTropolis is first launched, or when a new project is created by selecting **New-Project** from the File menu, mTropolis creates an untitled project with a single untitled section (Untitled Section 1), subsection (Untitled Subsection 1), shared scene (Untitled Shared Scene) and scene (Untitled Scene 1) as shown in Figure 2.1. See "Structure Window Overview" on page 8.81 for more information on the components of a mTropolis project.

Although the components of a project can also be viewed from two other windows (the structure window and the layers window), the layout window is the default view when



New, Open, Save, and Close for Projects

mTropolis creates a new project or opens an existing project.

More than one project can be opened simultaneously, although your system's RAM imposes a practical limit on the number of projects that can be open at once. See "Equipment and Memory Required" on page 1.17 for suggested hardware requirements for mTropolis.

Creating a New Project

- Choose **New-Project** from the File menu (or use ⌘-N). A new, untitled project is created and an empty project layout window (Figure 2.1) appears.

Opening an Existing Project

- Select **Open** from the File menu. A standard file selection dialog appears.

Closing a Project

- Make sure the layout window is in the foreground. Choose **Close** from the File menu (or use ⌘-W). If changes have been made to the project since the last save, an alert appears, asking if you want to save your changes before closing the project.
- Choose **Don't Save**, **Cancel**, or **Save**. If Save is chosen and the project has been saved previously, mTropolis re-saves the project under the existing name. If the project hasn't been saved previously, a standard file dialog appears, requesting a name and a destination before saving.
- *Note: Alternatively, projects can be closed by clicking in the close box in the layout window's title bar.*

Saving a Project

Choose **Save** from the File menu (or use ⌘-S). If the project has been saved previously,

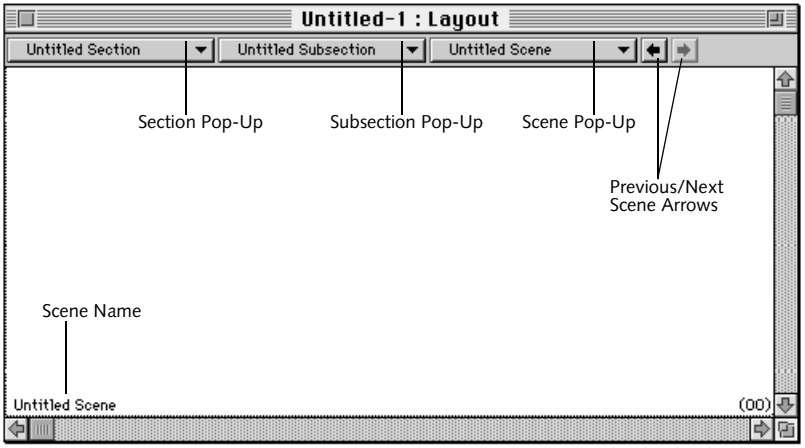


Figure 2.1 A new, empty layout window

mTropolis re-saves the project under the existing name. If the project hasn't been saved previously, a standard file dialog appears, requesting a name and a destination before saving. Any subsequent changes to the project are saved under the selected filename.

- *Note: Saving a project saves its structural elements and their associated modifiers and all links to external media. Media files are not saved with the project. They are stored outside the mTropolis environment.*

Renaming a Project

- Choose **Save As** from the File menu to save the current project under a new name. A standard file dialog appears, requesting a new name and location before saving.

- *Note: Saving a project using Save As reclaims the space used by deleted scenes, elements, and assets that were previously imported and then dragged to the Asset Palette's trashcan. Periodically using Save As during the development of a project can help keep the project's file size smaller.*

NEW, OPEN, AND SAVE FOR mTROPOLIS LIBRARIES

Libraries can be used to store project components (e.g., sections, subsections, scenes, elements and modifiers) in a file that is separate from the project. When a new library is created, or an existing library is opened, a library palette appears on the screen (Figure 2.2). Project components can be dragged to and from this palette. Multiple libraries can be open at once.

Libraries allow portions of projects to be distributed to development team members for selective editing. Libraries can also be used to archive project components for easy use in other projects.

- *Note: Projects cannot be stored in libraries.*

Creating a New Library

- Choose **New-Library** from the File menu (or use ⌘-Option-N). A new, untitled library appears.

Opening an Existing Library

- Choose **Open** from the File menu to display a standard file selection dialog. Select a library file from the dialog. The library palette appears.

Adding Items to a Library

- Drag sections, subsections, scenes, elements or modifiers from a project and drop them

Figure 2.2 A library palette

into the library palette. The component added to the library is represented by an icon along with its name.

- *Note: Modifiers that are stored in libraries retain their settings. However, some modifiers may have dependencies; that is, they may be dependent upon additional information to function correctly. For example, vector motion modifiers are dependent upon vector variables. If a functioning vector motion modifier is placed in a library and moved to another project, it will have to be reconfigured to reference a new vector variable.*

Deleting Items from a Library

- Drag the item to the library palette's trash can, in the upper left corner of the palette. The next time the library is saved, it is saved without the deleted items.

Saving a Library

- Click on the library palette's pop-up arrow. A pop-up appears.
- Choose **Save** from the pop-up to save the library under its current name. If the library hasn't been saved previously, a standard file dialog appears, requesting a name and a destination before saving. Choose **Save As** to save the library under a new name.

Closing a Library

- Close a library by clicking the close box in the library palette's title bar. If changes have been made to the library since it was last saved, an alert appears, asking if you want to save your changes before closing the library.

NEW AND OPEN FOR mTOONS—THE mTROPOLIS ANIMATION FORMAT

mTropolis includes support for proprietary, cel-based animation format files called mToons. An mToon is a series of images compiled by mTropolis into a single file. Any animation created in a 3D or 2D program that has been saved as, or converted to, PICT or PICS files can be imported by the mToon editor and processed as an mToon.

mToons are cel-based and very flexible. In addition to being able to specify the playback rate and duration of an mToon, a selected cel or range of cels in the mToon can be specified for playback. These ranges can be accessed during runtime, opening new creative possibilities to the multimedia author. For example, a rabbit's sitting, walking and running motions can be compiled into a single mToon linked to an element. During runtime, messengers or Miniscript can be used to specify which cels or range of cels in the animation to play back according to predefined conditions.

Single or multiple PICS or PICT files can be imported by the mToon editor. Ranges of cels within each animation can be defined and named. The mToon can be tested within the editor, optionally compressed and then saved as an mToon. Existing mToons can also be opened and edited in this window.

Creating a New mToon

To create a new mToon:

- Choose **New-mToon** from the File menu to open the mToon editor window. The mToon editor window appears.

Opening an Existing mToon

- Choose **Open** from the File menu to display a standard file selection dialog. Select an mToon file from the dialog. The mToon editor window appears, displaying the mToon frames. If source files for the mToon have changed since the mToon was last saved, a dialog appears. See "mToon Update Features" on page 2.33 for more information about the relationship between mToons and their source files.

The mToon Editor Window

The mToon editor window (Figure 2.3) is used to create and modify mToons. This window displays a single cel of the mToon animation, along with a number of controls. Controls for this window are described below.

Note that standard **Cut**, **Copy**, **Duplicate**, **Paste** and **Undo** menu items from the Edit menu can also be used while working in the mToon editor window.

Registration Point

By default, the registration point of each cel appears in its upper left corner. The registration point is the point used to align cels when the **Align and Trim Cels** mToon menu option (see page 2.27) is selected. Use the selection tool to drag the registration point

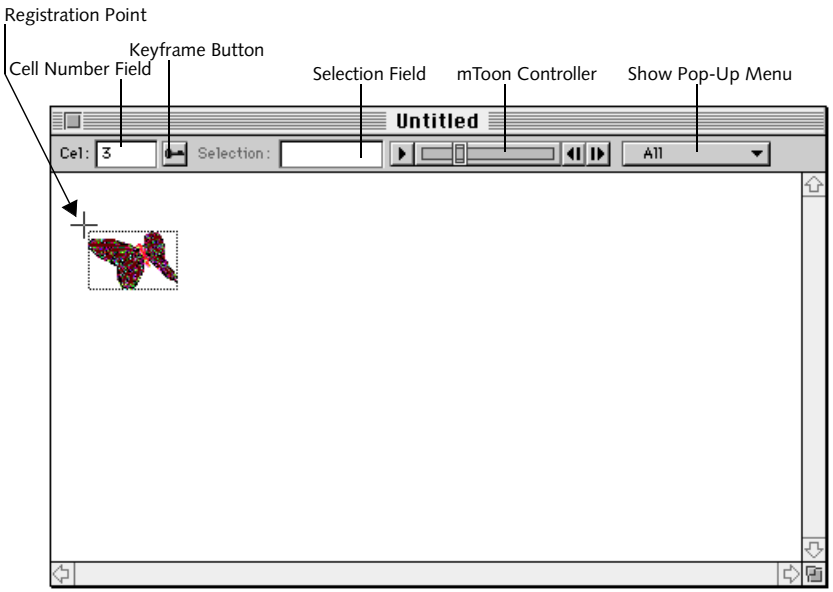


Figure 2.3 The mToon Editor Window

to a new location, or hold down the Option key and click on the screen to change the cel's registration point.

Cel Number Field
This field displays the number of the current cel.

Keyframe Button
Select this button to make the currently-selected frame a keyframe. This button is only available if the mToon compression options are configured to use temporal compression (see "Temporal Compression Check Box" on page 2.31). If temporal compression is not selected, every frame is considered a keyframe.

Selection Field
This field displays the range of cels that has been selected for editing.

mToon Controller
The controller is used to preview the animation, as well as to select a range of cels for editing. Use the step buttons to step forward or backward through the animation one cel at a time. Hold down the Shift key while stepping through cels to select a range of cels. Or, hold down the Shift key while dragging the slider to select a range of cels.

Show Pop-Up Menu
Options in this menu work in conjunction with the controller. Choose **All** to play all of the cels in the animation. To limit playback to a specific range of cels, select the name of the range from the **Show** pop-up.

Figure 2.4 The mToon menu

THE mTOON MENU

When the mToon editor window is open, the mToon menu (Figure 2.4) is available from the mTropolis menu bar.

Cels from PICT files, PICS files, QuickTime video files, or existing mToons can be imported by the mToon editor by using the options in the **Import** submenu. Other items on this menu, including play controls, editing tools and file info options, relate specifically to the cels in the mToon editor window.

mToon menu options are described below.

Import

Choose a menu item from the **Import** submenu in the mToon menu to import cels from a single file, multiple files, or a folder of files for processing. PICT, PICS, QuickTime, and mToon files can be imported.

Files within folders are imported according to the order assigned to them by the Finder. If any cels are currently in the mToon editor window, cels from the newly-imported file(s) are inserted sequentially after the last cel. The Edit menu's **Cut**, **Copy**, and **Paste** functions can be used to rearrange the order of individual cels after they have been imported.

Hot Tip

When creating source files in an external program, such as a 3D rendering package, save the animation frames as individual PICTs and compile them in the mToon editor. Saving files this way allows changed frames to be imported much more easily than if they are rendered to PICS files (wherein multiple images are stored as a single file).

Align and Trim Cels

Choose **Align and Trim Cels** from the mToon menu (or use ⌘-‘ (Command-left single quote)) to align the registration points of cels in the animation. At the same time, the background area of cels is trimmed based on the cels' background color. By default, this color is white, but can be changed using the Trimming dialog (see "Trimming" on page 2.29).

Key Frame

Select **Key Frame** from the mToon menu to make the frame currently displayed in the mToon window a keyframe. This option is only available if the mToon compression options are configured to use temporal compression (see "Temporal Compression Check Box" on page 2.31). If temporal compression is not selected, every frame is considered a keyframe. Selecting this menu option is the same as selecting the keyframe button on the mToon window.

Reverse Cel Order

Select **Reverse Cel Order** from the mToon menu to reverse the order of cels in the mToon. By default, the order of all cels in the animation is reversed. If a range of cels has been selected with the mToon controller, the order of only those cels is reversed.

mToon Menu Play Controls

Two options in the mToon menu allow the author to control the way an animation is played in the mToon editor window.

- Check the **Loop** menu toggle to repeatedly play the entire animation.
- Check the **Play Selection** menu toggle to play a selected series of cels in an animation.
- Check both the **Play Selection** and **Loop** menu toggles to loop a selected range of cels.

Assign Palette

Each animation created in the mToon editor can have its own custom palette.

To assign a palette:

- Choose **Assign Palette** from the mToon menu. A standard file dialog appears.
- Select the CLUT (color look-up table) file to be assigned to the animation.

By default, the mToon editor is set to display 256 colors. Use the Compression dialog (see

"Compression" on page 2.29) to change this setting.

Animations will be dithered to the system palette if no palette is assigned.

To be used in a project, mToons (and their custom palettes, if any) must first be linked to elements in the project. To display an mToon created with a custom color palette, place a color table modifier in the mToon's scene and select the table from the modifier's color table pop-up. The effect of the new CLUT will now be visible in runtime. To view the effect of a color table while in edit mode, select a color table from the **Preview Color Table** submenu in the View menu.

Ranges

Select this option to define sequences of cels in an mToon as named ranges. The Ranges dialog (Figure 2.5) appears. mToon ranges can be accessed by messengers or Miniscript during runtime. To play a named mToon range, send a *Play* command to the mToon with the desired range name as accompanying data. See "Played/Play" on page 13.238.

Hot Tip

To simplify programming, order your animations in a logical progression of cels whenever possible. For example, if several characters are to perform the same actions, for example, running, jumping, etc., design the cel ranges of these actions in the same pattern to reuse as much of the programming of ranges as possible.

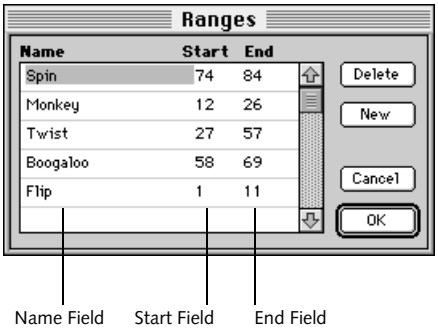


Figure 2.5 The Ranges dialog

To define a new range of cels:

- While in the mToon editor window, select a range of cels to be defined by holding down the Shift key while dragging the slider on the controller. The section of the bar corresponding to the selected cels is highlighted.
- Choose **New Range** from the mToon editor's Show pop-up to display the New Range dialog and type the name of the new range. Alternatively, choose **Ranges** from the mToon menu to display the Ranges dialog (Figure 2.5).

Components of the Ranges dialog are described below.

Delete Button

To delete a range, highlight the range name and click this button.

New Button

To create a new range from the Ranges dialog, click this button. An untitled range will be added to the bottom of the list. To define the

length of the new range, enter new values in the Start and End fields.

Name Field

Enter the new range's name or edit the name of an existing range in this text field.

End Field

The last cel of the range appears in this field.

Start Field

The first cel of the range appears in this field.

- *Note: Use the Tab key to move through the fields in this dialog.*

Hot Tip

To the extent that memory will allow, preload animations on a "parent enabled" message. Preloading allows them to play as quickly as possible and their cels and ranges can be switched instantaneously. See "Preload Media (Message/Command Menu Only)" on page 13.236.

Trimming

When the **Align and Trim Cels** menu item is selected, in addition to aligning the cels, the mToon editor automatically trims the white space from the background of each cel. This process optimizes the playback speed of an animation.

To specify a new color to be trimmed, or to turn Trim background information off, choose **Trimming** from the mToon menu. The Trimming dialog (Figure 2.6) appears.

Trim background information

To turn default trimming off, uncheck the "Trim background information" check box.

Figure 2.6 The Trimming dialog

Trim Color Check Box

To select a new trim color, click and hold on the swatch. The cursor will change to an eyedropper. Choose the background color to be trimmed from the animation and release the mouse button. Select OK to confirm changes. Select **Align and Trim Cels** from the mToon menu (or press ⌘-') to trim the newly-selected background color from the cels.

Compression

mToons can be compressed for optimal playback during runtime. mTropolis accesses the software compressors supplied with QuickTime. Choose **Compression** from the mToon menu to access the Compression dialog (Figure 2.7). Components of this dialog are described below.

Type Pop-Up Menu

This pop-up specifies the compression method to be used. The visual area displays a preview of the effect of the selected compression method.

Available compression methods (codecs) will vary according to the version of QuickTime installed on the author's system, but standard QuickTime options are described below. Some of the following descriptions are

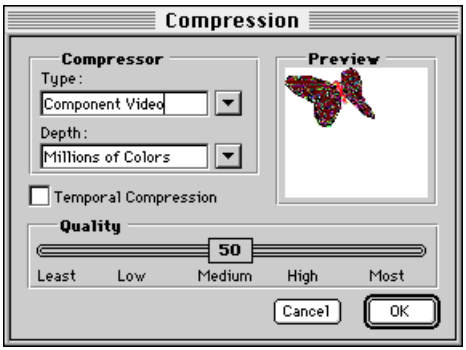


Figure 2.7 The Compression dialog

reprinted, with the permission of Adobe Systems Incorporated, from the *Adobe Premier 3.0 User Guide*:

- **Animation**: Use the Animation compressor for compression of images that were originally in digital form (animation and computer generated content) and were not obtained by videotape. The Animation compressor employs a compression algorithm developed by Apple based on run-length encoding techniques. The animation compressor works in a lossy or a lossless mode, and supports both spatial and temporal compression. This compressor can play back images at up to 30 fps at full screen resolution; the performance and compression ratios you achieve depend on the type of image you are using.
- **Cinepak**: Use the Cinepak compressor when compressing 16-bit and 24-bit video for playback from CD-ROM disks. This compressor attains higher compression ratios, better quality, and faster playback speeds than Video compression. For best results, use the Cinepak compressor on raw source data that has not been previously compressed with a highly lossy compressor. Decompression is much faster than compression with Cinepak, and the data rate for playback can be defined by the user.
- **Component Video**: A compression algorithm designed for use when capturing video. This codec is of limited use as an mToon compression method.
- **Graphics**: Specially designed for 8 bit (256 color) stills where compression ratio (file size) matters more than compression speed. Generally this choice will reduce an image to half the size of a file compressed using the animation compressor, but will take twice as long to do it.
- **None**: By selecting None, mToons remain uncompressed.
- **Photo-JPEG**: JPEG (Joint Photographic Experts Group) is an international standard for compressing still images. Use the Photo compressor for images that contain smooth transitions, or that do not contain a high percentage of edges or other sharp detail. Most natural images fall into this category. For this type of 24-bit image, the Photo compressor produces a reconstructed image that is virtually indistinguishable from the original image at a compression ratio of 10:1. Compression time is equal (or very nearly equal) to decompression time.

- **Video**: Use the Apple Video compressor for capture and compression of analog video, high-quality playback for hard disk, and moderate quality playback from CD-ROM. This compressor supports both spatial and temporal compression, and can playback at rates of 10 fps or more. Data can be later recomposed or recompiled for higher compression ratios. The Apple Video compressor allows recompression with minimal or no quality degradation.
- **mFactory Animation**: This codec is a mFactory's own lossless, cross-platform, QuickTime-independent compression method for mToons. This compressor is nearly identical to QuickTime's Animation compressor and uses a run-length encoding (RLE) scheme. Currently, this codec supports only 8-bit color (i.e., 256 colors). Since this codec is supplied by mFactory, and is not part of the QuickTime distribution, it can be used in either Macintosh or Windows titles without QuickTime having to be licensed or installed on target machines. The Build Title dialog contains options for automatically converting uncompressed or QuickTime Animation codec compressed mToons to the mFactory Animation codec at build time. See "mToon Conversion Options Section" on page 2.42.

Some compression methods use delta compression, where one frame is differenced from a previous frame. When random access to an individual cel is made during runtime, a lag in access time results, since the accessed cel must be recreated from one or more previous cels.

Depth Menu

Sets the number of colors used by a new mToon. The default color depth is 256 colors.

Temporal Compression Check Box

Check this box to perform temporal compression on the mToon. By default this option is off. Temporal compression shrinks the mToon's file size, but individual frames are no longer randomly accessible. mToons that are *not* temporally compressed may play faster than ones that are. Note that this option is not available for all compression Type settings. When this option is selected, the keyframe button on the mToon editor window becomes active (see "Keyframe Button" on page 2.26).

Compression Quality Slider

The position of this slider affects the quality of the chosen compression method. Lower quality settings result in smaller file sizes and faster mToons, but introduce artifacts.

Cancel

Click Cancel to ignore changes to compression settings.

OK

Click OK to accept changes made to compression settings.

Hot Tip

Larger animations that are loaded from a CD will need to be compressed to load more quickly. Files that need to run very quickly can be left at a compression of "none"; however, beyond 1 MB in size, they will take more time to

Figure 2.8 The mToon Info dialog

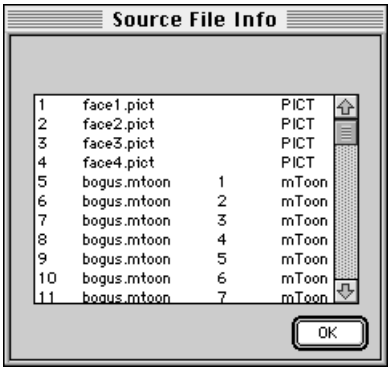


Figure 2.9 The Source File Info dialog

load. In the prototype stage, test various compression methods to determine which is appropriate for the specific animation you are building.

mToon Info

Choose **mToon Info** from the mToon menu to display the mToon Info dialog (Figure 2.8).

The mToon Info dialog displays information about the current animation.

Source File Info

Choose **Source File Info** from the mToon menu to display information about the source files that are linked to the current animation. The Source File Info dialog (Figure 2.9) appears. More information about the relationship between mToons and their source files can be found in "mToon Update Features" on page 2.33. Components of the Source file Info dialog are described below.

Path Display

The path to the source file of the selected cel is displayed here.

The source files for the cels of an animation are displayed in a list. The list elements, from left to right, are:

Cel Column

The cel number assigned to the source file.

Original File Name

The name of the original source file.

Index number from Animation File

If the source file is a PICS, mToon, or QuickTime file, the index number of the cel is displayed in this column.

File Format

The file format of the imported file is listed in this column.

Saving mToons

mToons can be saved using standard procedures.

Saving a New mToon

- With the mToon window selected as the current window, choose **Save** from the File menu (or use ⌘-S). If the mToon has been

saved previously, mTropolis re-saves the mToon under the existing name. If the mToon hasn't been saved previously, a standard file dialog appears, requesting a name and a destination before saving. Any changes made to the mToon are saved under the file name.

Renaming an mToon

- With the mToon window selected as the current window, choose **Save As** from the File menu to save the mToon under a new name. A standard file dialog appears, requesting a new name and a destination before saving.

mToon Update Features

Information about the source files from which an mToon animation is created is stored inside the mToon file. This information can be seen by selecting **Source File Info** from the mToon menu. If source files have been changed, the mToon editor can be used to easily recompile the mToon from the altered source files. Open the mToon file and mToon editor window by selecting **Open** from the File menu. If you select an mToon file that has a changed source file, mTropolis displays an alert saying that source files have changed and they are being updated. The mToon editor appears with the updated animation cels. Select **Save** from the File menu to recompress the mToon with the changed cels.

OPENING PROJECTS, LIBRARIES AND mTOONS

Previously-saved projects, libraries, or mToons can be opened using standard procedures.

- Choose **Open** from the File menu (or use ⌘-O) to open an existing project, library, or mToon.
- *Note: Double-clicking on a project, library, or mToon from the Finder will open the selected file and will also launch mTropolis if it isn't already launched.*

Re-Linking External Media Files

When a project, library, or mToon is saved, mTropolis saves the links (path names) to its external media files. If any media files were deleted, moved, or renamed since the project, library, or mToon was last saved, mTropolis automatically searches for the media.

This search starts from the location of the project file and continues down through the folder and disk volume hierarchy. Initially, mTropolis searches for media contained in the first scene and its elements. Once the project has been opened, any other media files that are missing are searched for when the scene that contains those files is navigated to (during runtime or edit mode).

If the name of a media file has changed since the project was last opened, the search will be unsuccessful and a file dialog is displayed (Figure 2.10).

Figure 2.10 Re-linking a missing media file.

When this dialog appears, the following options are available:

- The file dialog can be used to navigate to the missing file. Once selected, the **Open** button changes to **Re-link**. Click **Re-link** to cause the selected file to be linked to the project, replacing the original link.
- Click the **Search** button to display a folder selection dialog. Select a folder in which to search for the media. That folder and all its subfolders will be searched. If the file is found, it is automatically re-linked to the project. If the file is not found, the file dialog is displayed again.
- Click the **Skip** button to ignore the need for this file and return to the project. If the file was previously linked to an element, its thumbnail (if available) is used in place of the actual media. Even if the project is saved, this media file will again be searched for the next time the project is opened. To remove any reference to the file, it must be deleted from the Asset Palette.
- Click the **Skip All** button to ignore the need for this file and any others that may also be missing. This option is otherwise identical to the **Skip** option.

LINK MEDIA—ATTACHING EXTERNAL MEDIA FILES TO ELEMENTS

mTropolis stores the path to external media files and refers to these files as required. The **Link Media** submenu in the File menu is used to establish the path or "link" between the project and external media files.

The **Link Media** command can be used to link media to a selected element in any of mTropolis' editing views—the structure, layout, and layers windows—or multiple files can be linked to the asset palette. Use **Link Media - File** (or ⌘-L) to link a single file to a selected element. Use **Link Media - Multiple Files** (or ⌘-option-L) or **Link Media - Folder** to link groups of files to the asset palette.

- For instructions on how to create and link media to elements in the structure view, see "Creating New Sections, Subsections, Scenes and Elements" on page 8.84.
- For instructions on linking media in the layout view, see "Linking Media to an Element in the Layout Window" on page 9.91.
- For instructions on linking media in the layers view, see "Linking Media to Elements in the Layers Window" on page 10.100.
- For information on linking media to the asset palette, see "Linking Media to the Asset Palette" on page 11.114.

Media Types Supported by mTropolis

The following media formats can be linked to mTropolis elements:

- **Images**: PICT files, including PICT files saved with JPEG compression. Note that mTropolis does not retain alpha-channel information from 32-bit images.
- **Animation**: mToons, mTropolis' proprietary animation format. See "New and Open for mToons—the mTropolis Animation Format" on page 2.24. mToons can be created from source files in PICT, PICS, or QuickTime formats.
- **Sound**: AIFF files of any bit-depth and sampling rate, though compressed sounds are not currently supported. mTropolis can make use of AIFF sound markers when playing sounds, as described in "Played/ Play" on page 13.238.
- **Video**: QuickTime movies can be linked to elements in edit mode. Multitrack QuickTime movies can be created with the MovieTrax application (described in Appendix A. "MovieTrax") and manipulated with the Track Control Modifier (page 12.219). Video for Windows files (AVI files) can be used in titles built for Windows platforms as described in "Make Movies External Checkbox" on page 2.40, but AVI files cannot be imported directly into the mTropolis editing environment.
- **Panoramic Video**: QuickTime VR panorama and object movie files can be linked to a mTropolis project. Currently, QuickTime VR movies always play "direct to screen"; they are not part of the mTropolis layer order and ink effects cannot be applied to them.
- **Color Tables**: To provide appropriate colors for 8-bit images, mTropolis supports color tables (i.e., palettes) in the CLUT (Color Look Up Table) format supported by many imaging applications, including Adobe Photoshop. CLUT files can only be linked to the color table modifier or to the Asset Palette—they cannot be linked directly to graphic elements. See "Color Table Modifier" on page 12.141.

BREAK LINK

Select **Break Link** from the File menu to break an element's link to a media file while leaving all other information related to the element intact. To use this feature:

- Select the element. Use Shift-Click to select multiple elements.
- Choose **Break Link** from the File menu. All aspects of the selected elements, including their frames and modifiers, will remain intact, but they are no longer linked to their media files.

REMOVE UNUSED ASSETS

Choose **Remove Unused Assets** from the file menu to remove media assets that have been linked to the current project but are not used anywhere in the project's structural hierarchy. To identify which assets are unused,

mTropolis must load the entire project into memory. If parts of the project are not yet loaded, mTropolis displays a warning that the project is being loaded. Once the unused assets have been identified, they are removed from the project and their names and thumbnails disappear from the Asset Palette.

RUN—SWITCHING BETWEEN EDIT AND RUNTIME MODES

When mTropolis is first started, the program is in *edit mode*. Authoring occurs in edit mode, but the project can be previewed by entering *runtime mode*. In runtime mode, the project is shown as it will appear to users.

Running a Project from its First Scene

- Choose **Run-From Start** from the File menu (or use ⌘-T) to switch to runtime mode and preview the project from its first scene. This scene is the first scene in the first subsection in the first section you see in the structure window.
- Normally, the project is displayed over a black background. To keep the mTropolis interface visible during runtime, press ⌘-Option-T instead.
- Press ⌘-T again to return to the scene where ⌘-T was originally pressed. Optionally, use ⌘-. (Command-period) to re-enter edit mode with the current runtime scene displayed in the layout window.

Running a Project from a Specific Scene

- Choose **Run-From Selection** from the File menu (or use ⌘-Y) to switch to runtime and preview the project from the current scene.
- Normally, the project is displayed over a black background. To keep the mTropolis interface visible during runtime, press ⌘-Option-Y instead.
- Press ⌘-Y again to return to the scene where ⌘-Y was originally pressed. Optionally, use ⌘-. (Command-period) to re-enter runtime mode with the current runtime scene displayed in the layout window.

Player Emulation

The **Player Emulation** menu toggle controls the way in which the mTropolis editor's runtime mode functions. When this option is checked (the default), the editor's runtime mode emulates the behavior of the stand-alone mTropolis player applications. The project behaves much as it would if it were built into a title file and run with a mTropolis player. However, the following differences and issues should be noted:

- If their values are changed, variables located *above* the scene level (i.e., contained in the Subsection, Section, or Project components) always retain their changed values upon return to edit mode. Other variables (i.e., variables at the scene level and lower) that change during runtime are reset to their original values. The behavior of variables in runtime mode can be a

source of confusion when testing a mTropolis project. For more information on this topic, see "Variable Persistence" on page 13.254.

- Any changes to the attributes of *scenes* are retained upon returning to edit mode. Attributes of other components that change in runtime are reset to their original values upon return to edit mode.
- If the project has not been saved prior to entering runtime mode, mTropolis saves the current project to a temporary file so that the project can be fully restored upon returning to edit mode.
- When entering runtime mode, all objects that have been loaded into memory (e.g., any scenes that have been edited, media assets, thumbnail versions of assets, etc.) are purged from memory. Upon returning to edit mode, these objects are reloaded to restore the editing environment to its previous state.

  However, it is possible that due to insufficient memory, mTropolis will not be able to restore the structure view to the same state in which it was left. In this case, an alert is displayed and the structure view appears with all of its open/close triangles closed. Note that no project data is lost in this situation—the structure view is just reset to its simplest state.

Runtime Behavior when Player Emulation is Disabled

When the **Player Emulation** option is *not* checked, changes made in runtime mode are persistent (i.e., they are retained upon returning to edit mode). In this mode, persistent changes include:

- Components created by the *Clone* command become part of the project in edit mode.
- Components destroyed by the *Kill* command are no longer present in the project and cannot be recovered.
- Attributes—such as position, size, visible, layer, parent, asset, etc.—changed during runtime remain changed in edit mode. Note that this feature can be useful as an editing technique—for example, a Miniscript modifier could be used to accurately set the positions and layers of numerous elements. The script could then be removed.
- Draggable elements moved in runtime retain their new positions in edit mode. Similarly, elements that have moved via vector motion retain their new positions.
- The values of *any* variables that are changed in runtime remain changed in edit mode. The behavior of variables in runtime mode can be a source of confusion when testing a mTropolis project. For more information on this topic, see "Variable Persistence" on page 13.254.
- *Note: Switching Player Emulation off causes an alert to appear. This alert notifies the author that all changes made in runtime mode will be preserved. This alert can be kept from reappearing in the current mTropolis session by*

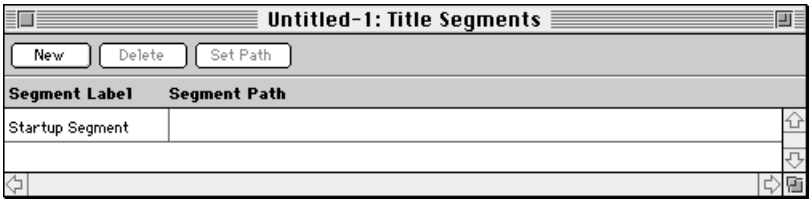


Figure 2.11 The Title Segments window

selecting the "Don't Warn Again" button when the alert appears.

TITLE SEGMENTS

Select **Title Segments** to display the Title Segments window (Figure 2.11). Use this window to create and manage *title segments*—groups of project sections that are written to the same file when the project is built into a standalone title (see "Build Title" on page 2.39).

By default, a mTropolis project is built into a single *title file* that can be "played" by a mTropolis player. However, large projects may result in a single title file that is too large to fit on the desired distribution media. For example, the project may need to be "split up" for distribution on multiple CDs. Use the Title Segments window to create a title that consists of multiple title segment files. Components of this window are described below.

New Button

Select this button to create a new title segment. A new segment label with a default name appears in the "Segment Label" list.

Delete Button

Select this button to delete the currently highlighted title segment. A segment label or segment path must be highlighted for this option to be active.

Set Path Button

Select this button to select a folder in which this title segment will be written when the title is built. A standard folder selection dialog appears. When a folder is selected, its path appears in the "Segment Path" list.

Segment Label List

This list shows the names of currently defined title segments. Click on a name to edit the name or to select it for the New, Delete, or Set Path operations. Note that the segment labeled "Startup Segment" cannot be edited or deleted—all mTropolis titles have a startup segment.

Segment Path List

Items in this list show the path to the location in which the corresponding title segment will be written. There are two ways to change the path:

- Select the path and edit it from the keyboard. The path must be entered in

proper Macintosh path syntax (i.e., a colon separated list of drive/folder names).

- Select the path or corresponding segment label and click the Set Path button. A standard folder selection dialog appears. When a folder is selected, its path appears in the list.

Assigning Sections to Title Segments

By default, all sections in a project are assigned to the Startup Segment. When they are first created, new title segments are not associated with any sections in the project. Sections must be assigned to new title segments for those segments to be created during the "Build Title" process. To assign a section to a title segment:

- Open the structure window (if it is not already open) by selecting **Structure Window** from the View menu (or press ⌘-2).
- In the structure window, select the section to be reassigned, then select **Element Info** from the Object menu. The Section Info dialog (Figure 2.12) appears. You can also double-click on the section to display this dialog.

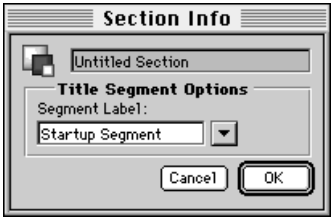


Figure 2.12 The Section Info dialog

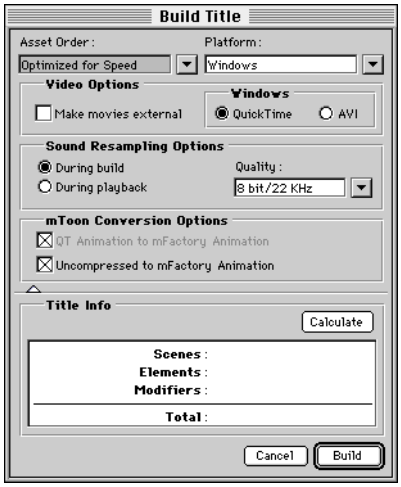


Figure 2.13 The Build Title dialog

- Use the Segment Label pop-up menu to select the segment for this section. A new segment can be created from this pop-up by selecting **New Segment Label**. A prompt appears for entering the new label.
- Click OK to confirm the new title segment association and dismiss the Section Info dialog.

BUILD TITLE

When the project is complete, it can be built into a stand-alone title for Macintosh or Windows platforms. Select **Build Title** from the File menu to display the Build Title dialog (Figure 2.13). Components of this dialog are described below.

Asset Order Pop-Up

Select an optimization option from this menu. These options control the way in which media

assets are written into the built title file or files. Options include:

- **Optimized for Speed**: Select this option to place an instance of each media asset in the order in which it is used in the project. For every scene in which an asset appears, a copy of the asset is written to the built title file. For example, if an asset appears in three scenes, it will be written to the title file (or files, in the case of segmented titles) three times.

  This option creates a title with optimal performance, at the expense of disk space. To conserve space, individual assets can be set to write only once, each time they appear in a segment. A checkbox in the Asset Info dialog controls this behavior. See "Build Options Section" on page 6.66.

- **Optimized for Space**: Select this option to place only the first instance of an asset in the project. Selecting this option makes the built title smaller than it might otherwise be when built for speed. However, scenes may take longer to load as media used in multiple places in the project must be loaded from a single location in the built title file (or files, if multiple segments are written).

Platform Pop-Up Menu

Use this pop-up to select the type of platform for which the title will be built. Options are "Macintosh" (the default) and "Windows". mTropolis title files will be built for the selected platform. Note that not all mTropolis features are available in titles built for Windows. See "mTropolis Features not Supported in Titles Built for Windows Platforms" on page 2.43.

Video Options

The Video Options section is enabled when building titles for Windows platforms (i.e., when "Windows" is selected in the Platform pop-up). These options control the way QuickTime and Video for Windows files are handled when building Windows titles.

Make Movies External Checkbox

Check the "Make movies external" checkbox to save movies as external files instead of including them in the title segment file(s). The video files are saved in the folders of the segments that require them. If multiple segments of the title require the same movie, the movie file is duplicated and placed in each appropriate folder.

- *Note: If this option is selected when building a Windows title, QuickTime movies are automatically written in QuickTime's "playable on Windows" format.*

Windows Radio Buttons

These radio buttons become active when building a title for Windows platforms:

- **QuickTime**: Select this radio button (the default) to use the same QuickTime files, used when authoring the title, in the final build.

- **AVI**: Select this radio button to replace the QuickTime files used when authoring the title with AVI (i.e., Video for Windows)

versions in the final build. To use this option, you must have AVI versions of the QuickTime files—mTropolis does not automatically convert video between these formats. Put the AVI files in the same location(s) as their QuickTime counterparts before starting the build title process. These AVI files must have the same names as the QuickTime files, except for a ".AVI" extension. For example, the file "myMovie.mov" must have an AVI version named "myMovie.AVI".

- *Note: Quicktime VR panorama and object movies cannot be converted to AVI format.*

Sound Resampling Options

The Sound Resampling Options section is enabled when building titles for Windows platforms (e.g., when "Windows" is selected in the Platform pop-up). These options control the way sound media files are handled when building Windows titles.

During Build

Resampling during the build process results in all sounds in the project being resampled to conform to the bit resolution and sample rate selected in the "Quality" menu. The sounds are upsampled or downsampled as they are written to the title files. As a result, they may take up more or less disk space than their original versions, but Windows will never have to perform sound conversions during runtime.

During Playback

Resampling during playback causes all sounds to be written to the title file at their native quality. However, no matter what their actual bit resolution and sample rate, they are resampled as specified by the "Quality" menu when they are played. Thus, the Windows player must perform sound conversions during runtime. Depending upon the speed of the playback machine and the number of conversions being performed, this conversion may result in reduced performance. Note also that if the playback machine does not support the specified sample rate, the next best quality will be used.

Quality

Use this pop-up menu to specify a bit resolution and sample rate for use with the "During build" and "During Playback" sound options. Options are:

- **16 bit/44 KHz**: The highest quality sound supported by mTropolis, "CD quality". Sounds written in this format require the maximum amount of disk space.
- **16 bit/22 KHz**: High-quality, 16-bit sound.
- **8 bit/22 KHz**: The default medium-quality, 8-bit sound.
- **8 bit/11 KHz**: The lowest-quality sound supported by mTropolis. Sounds written in this format require the least disk space.
- **Dynamic**: This special Quality option is only available when "During playback" has been selected as the sound resampling option. When this option is enabled, sounds are written to the title file at their native quality.

At runtime, they are played at their native quality, except when multiple sounds are made to play at the same time. When multiple sounds are played simultaneously, the quality of the first sound played is used to resample any others. For example, if an 8-bit, 22KHz sound is playing, then a 16-bit, 44KHz sound is made to play at the same time, Windows will "downsample" the 16-bit sound (affecting its quality adversely). Similarly, if the 16-bit, 44KHz sound started playing first, the 8-bit 22KHz sound would be "upsampled".

In addition to matching the bit-depth and sample rate of sounds, this behavior also causes the sounds stereo or mono qualities to be matched. That is, if a stereo sound plays first, any simultaneously played mono sounds are converted to stereo (and vice-versa).

Thus, this setting can cause unpredictable sound performance on Windows and should only be used in projects where the programmer has carefully controlled the order in which sounds of differing qualities might be played.

mToon Conversion Options Section

Two checkboxes in this section of the Build Title dialog control build-time compression options for uncompressed mToons and mToons compressed with the 8-bit QuickTime Animation codec. These options affect both Macintosh and Windows builds:

- **QT Animation to mFactory Animation checkbox**: When this checkbox is selected (the default), mToons compressed with the 8-bit (i.e., 256 colors) QuickTime Animation codec are recompressed using the mFactory Animation codec when written into the built title file. The mFactory Animation codec has the advantages of not requiring QuickTime to be installed and providing a cross-platform compression method for mToons. In general, it offers better performance than the QuickTime Animation compressor. See "Compression" on page 2.29.
- Uncompressed to mFactory Animation checkbox: When this checkbox is selected (the default), 8-bit (i.e., 256 color) mToons saved without compression are recompressed using the mFactory Animation codec when written into the built title file. The compressed mToons take up less space than uncompressed mToons and have comparable playback performance. See "Compression" on page 2.29.

Title Info Section

Click the triangle at the bottom of the Build Title dialog to display the Title Info section.

Click the **Calculate** button to calculate and display the number of scene, element, and modifier components present in the project.

Cancel Button

Select "Cancel" to dismiss the Build Title dialog and abort the build title process.

Build Button

Click the "Build" button to begin compiling the project into a title. If there are title segments that do not have "segment paths" defined (see "Title Segments" on page 2.38), a standard folder selection dialog appears for each title segment. Select a folder to be used to contain that segment's files. Note that once a location has been selected, it is remembered for future builds (the Title Segments window can be used to change the path for the segment).

Files Created by the Build Title Process

mTropolis creates the following types of files during the Build Title process:

- **Startup Segment File**: All mTropolis projects have a Startup Segment file. This file is written to the folder specified in the Title Segments window. For Macintosh builds, this file is given the name of the project, appended with "1". For example, for a project named "myProject", the startup segment is written as a file named "myProject1". For Windows builds, this file is given the name of the project truncated to seven characters and appended with "1.MPL". For example, for a project named "myProject", the startup segment is written as a file named "MYPROJE1.MPL". The Startup Segment has the icon shown below.

- **Other Segment Files**: If any title segments (other than the Startup Segment) were defined and associated with project sections, corresponding data segment files are written. They are written to folders as specified in the Title Segments window. For Macintosh builds, these files are given the name of the project, appended with a number (e.g., "myProject2", "myProject3", etc.). For Windows builds these files are given the name of the project, truncated as necessary to fit the name and segment number into eight characters, appended with the segment number and ".MPX" (e.g., "MYPROJE2.MPX", "MYPROJE3.MPX").

- **Video Folder**: If the "Make movies external" checkbox was selected in the Build Title dialog, a folder named "Video" is created for each segment that needs a video file. The folder resides in the same folder as its corresponding segment file. The "Video" folder contains the externalized video files, each named with a number and an extension (".mov" for QuickTime files, ".AVI" for Video for Windows files).

mTropolis Features not Supported in Titles Built for Windows Platforms

Note that not all mTropolis features are available on the Windows platform in this release. See the mTropolis release notes for specific information about differences between titles built for Windows and Macintosh platforms.

PLAYING mTROPOLIS TITLE FILES

To play titles built with mTropolis, you need the following files:

- Segment files and folders created by the Build Title process.
- The appropriate version of mTropolis Player for the target machine. The mTropolis CD-ROM contains three Macintosh players—68K-only version, Power Macintosh-only version, and a version for any Macintosh. There are two versions of the Windows player—"MTPLAY31.EXE" for Windows 3.x, and "MTPLAY95.EXE" for Windows 95.
- The accompanying resource folder (for Macintosh) or subdirectory (for Windows) for the player. If you are deploying a title for both Windows 3.1 and Windows 95 players, the contents of their "RESOURCE" directories should be combined into a single "RESOURCE" directory.

These files and "top-level" folders should be put in the same folder (for Macintosh or Windows 95) or subdirectory (for Windows 3.x).

Running the Title

A mTropolis title can be played in one of four ways:

- Launching a mTropolis player with a startup segment in the same folder/directory causes that startup segment to be run. That is, the player automatically runs the startup segment located in the same directory. This is the recommended configuration for a mTropolis-built title.

  Note that only one startup segment should be placed in the player's folder/directory. If multiple startup segments are present in this directory, there is no way to determine which one will be run.
- Launching a mTropolis player without a startup segment present starts the player without playing a title. A startup segment can be selected manually. On Macintosh, choose **Open** from the File menu. A file selection dialog appears. Use the dialog to select a startup segment to be run. On Windows, a file selection dialog appears automatically. Use the dialog to select a startup segment file (i.e., a ".MPL" file) to be run.
- Double-clicking or running a startup segment file causes that title to be run with a mTropolis player, if one is available. If multiple copies of the mTropolis player are installed, there is no way to tell which one will be run.
- Dragging a startup segment file onto a mTropolis player causes that title to be run with that player executable.

During runtime, the mTropolis player can be quit by pressing **⌘-Q** on Macintosh or **Alt-F** followed by **x** on Windows.

Customizing Title Filenames, Location, and Icons

The mTropolis player executable and the startup segment can be renamed or moved to another folder/directory with the following restrictions:

- The player's Resource folder and the title's Video folder (if it has one) must also be moved to the same folder as the player. These folders *must not* be renamed.
- Other segment files (if defined) cannot be moved or renamed—the exact paths set in the Title Segments dialog are used by the player to locate segment files other than the startup segment.

Hot Tip

Since the startup segment and player can be moved together to another location, frequently-accessed scenes can be assigned to the startup segment, which can then be copied to the end-user's hard disk for fastest access.

Macintosh or Windows resource editors can be used to customize the mTropolis player icon. A custom title with single-icon launching can be created by changing the name and icon of the mTropolis player (though both the player and startup segment must still reside on the user's hard disk).

Deploying Multiple-Disc Titles

Because the mTropolis player code may be loaded dynamically during runtime, the mTropolis player and its Resource directory must always be available on a mounted volume. For multiple-disc titles, this means that the player must be copied to the end-user's hard disk. The startup segment and its Video folder (if it has one) must be copied to the same location as the player if the title is to run automatically.

To minimize the size of the startup segment, ensure that all sections in your project are assigned to other segments. Alternatively, use the startup segment on the hard disk to hold sections that will be accessed frequently or that contain high-bandwidth media.

QUITTING mTROPOLIS

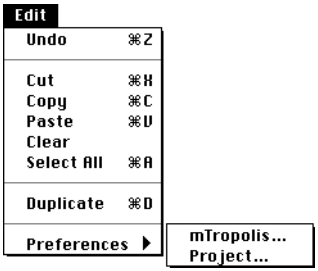
- Choose **Quit** from the File menu (or use ⌘-Q) to exit the mTropolis environment.

If changes have been made to the project since the last save, an alert appears, asking if you want to save your changes before closing the project.

- Choose **Don't Save**, **Cancel** or **Save**. If Save is chosen and the project has been saved previously, mTropolis re-saves the project under the existing name. If the project hasn't been saved previously, a standard file dialog appears, requesting a name and a destination before saving.
- *Note: If multiple projects are open, mTropolis quits each one in sequence.*

Quitting mTropolis

Chapter 3. Edit Menu



The Edit menu contains project editing functions, such as **Undo**, **Cut**, **Copy** and **Paste**. It also provides access to preferences for mTropolis and for the current project.

Most of the project editing functions are available in mTropolis' three project windows (layout, structure and layers). Editing functions that are not valid for the current selection are dimmed.

UNDO

The Undo menu item restores the project to its state prior to the last change.

To undo the last operation:

- Choose **Undo** from the Edit menu (or use ⌘-Z).

CUT, COPY, PASTE

mTropolis has a clipboard where project components or text selections can be temporarily stored using the Edit menu's **Cut** and **Copy** menu items. The **Paste** menu item is used to place the clipboard's contents on selected locations in the current project, or on selected locations in another project. The menu items are context sensitive. For example, an element cannot be pasted at the project level.

Text selections, elements, modifiers, behaviors, sections, subsections and scenes can be cut, copied and pasted. Items can be cut, copied and pasted between project windows.

If the clipboard is empty, the **Paste** options appears greyed out in the Edit menu.

To cut, copy, or paste an item:

- Select the desired item with the tool palette's selection tool.
- Choose **Cut**, **Copy** or **Paste** from the Edit menu. Alternatively, the keyboard shortcuts shown in Table 3.1 can be used:

Operation	Shortcut
Cut	⌘-X
Copy	⌘-C
Paste	⌘-V

Table 3.1: Edit menu shortcuts

CLEAR

The Edit menu's **Clear** menu item is used to delete any item from the project, with the exception of items in palettes, which are

deleted by dragging them to a palette trash can. Cleared objects are deleted without being copied to the clipboard.

To clear an item from the project:

- Select the item to be cleared in any window.
- Choose **Clear** from the Edit menu. The item is deleted from the project.

SELECT ALL

Use the **Select All** menu option (or press ⌘-A) to select all of the items in an active window, including those that are not currently visible. This command can be used to quickly select a large group of items. After all items have been selected, individual items can be removed from the selection group by Shift-Clicking them.

DUPLICATE

The Edit menu's **Duplicate** menu item creates a copy of a selected item. This option combines the functionality of **Copy** and **Paste**, without affecting the contents of the clipboard.

To duplicate an item:

- Select the item with the tool palette's selection tool.
- Choose **Duplicate** from the Edit menu (or press ⌘-D). The duplicated item automatically appears near the original.

PREFERENCES-mTROPOLIS

Select **Preferences-mTropolis** from the Edit menu to set preferences for mTropolis. The mTropolis Preferences dialog (Figure 3.1) appears. This dialog can be used to change a number of different preference types. Use the "Show" pop-up menu to select different preference types. The dialog changes to show applicable settings. These settings are described below.

General

By default the mTropolis Preferences dialog opens to display general mTropolis preferences (Figure 3.1). Components of this dialog are described below.

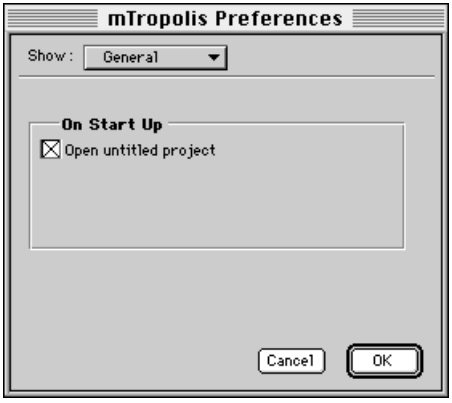


Figure 3.1 General mTropolis Preferences

Open Untitled Project on Start Up Check Box
When selected, mTropolis opens a new, untitled project at start-up. When deselected, mTropolis launches without creating an untitled project.

Layout

To set layout preferences, choose Layout from the Show pop-up in the mTropolis Preferences dialog (Figure 3.2).

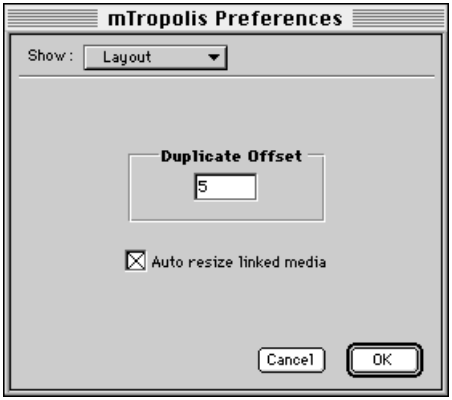


Figure 3.2 Layout mTropolis Preferences

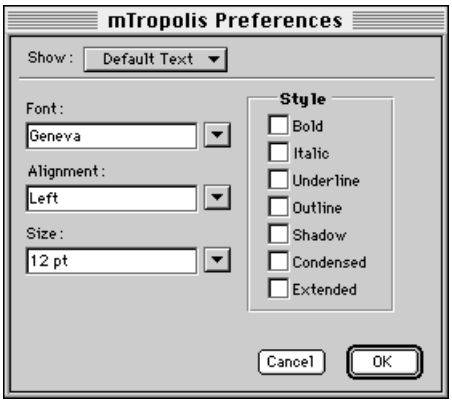


Figure 3.3 Type mTropolis Preferences

Duplicate Offset Field

Use this field to specify the offset for new elements created by selecting **Duplicate** from the Edit menu. By default, elements duplicated in the layout window are offset 5 pixels to the right and 5 pixels below the original.

Auto Resize Linked Media Checkbox

This option automatically resizes elements to the screen dimensions of linked external media. The default is on.

Default Text

To set preferences for the default type used in text elements, choose **Default Text** from the Show pop-up in the mTropolis Preferences dialog (Figure 3.3).

Font Pop-Up Menu

Select mTropolis' default text font from the pop-up.

Alignment Pop-Up Menu

Select mTropolis' default text alignment from the pop-up.

Size Pop-Up Menu

Select mTropolis' default text font size from the pop-up.

Style Checkboxes

Select mTropolis' default text font style by clicking the appropriate checkboxes.

Libraries

To set library preferences, choose **Libraries** from the Show pop-up in the mTropolis Preferences dialog (Figure 3.4). Use these preferences to specify any libraries that should be opened whenever mTropolis is started.

Open with Application List

The library or libraries to be opened along with the application are listed here. More information on libraries can be found in "New,

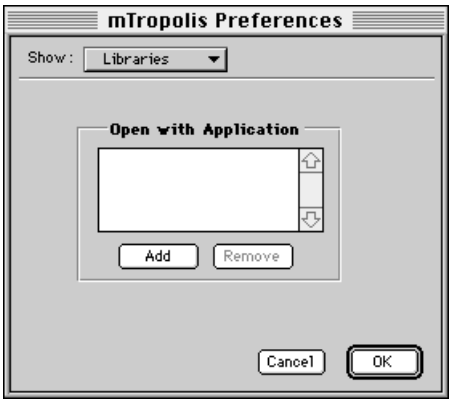


Figure 3.4 Libraries mTropolis Preferences

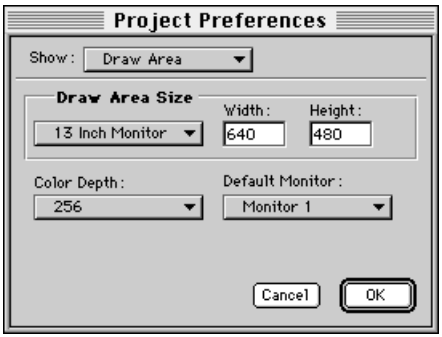


Figure 3.5 Draw Area Project Preferences

Open, and Save for mTropolis Libraries" on page 2.23.

Add Button

Click this button to display a standard file dialog. Libraries selected from the dialog will be added to the list. These libraries will be automatically opened with the application.

Remove Button

To prevent a library from opening with the application, select it from the list and click the Remove button.

PREFERENCES-PROJECT

Select **Preferences-Project** from the Edit menu to set preferences for the current project. The Project Preferences dialog (Figure 3.5) appears. This dialog can be used to change a number of different preference types. Use the "Show" pop-up menu to select different preference types. The dialog changes to show applicable settings. These settings are described below.

Draw Area

To set the draw area preferences, choose Draw Area from the Show pop-up in the Project Preferences dialog. The "draw area" is the visible area of the project when viewed in runtime mode.

Draw Area Size Pop-Up Menu

Select the size of the monitor on which the title is targeted to be displayed. Options include 9-Inch Monitor, 12-Inch Monitor, 13-Inch Monitor, 15-Inch Monitor, Current Monitor, and Custom.

Draw Area Size Fields

These fields automatically display the draw area size of the monitor selected from the Size pop-up.

To specify a custom draw area size, choose Custom from the pop-up and enter new pixel values in these fields.

Color Depth Pop-Up Menu
Select the color depth of the project from this pop-up. Options include B/W (black and white), 256 colors (8-bit), Thousands (16-bit), and Millions (32-bit).

This setting controls the bit depth of the off-screen buffer for the project. When the project is built into a title file, PICT and mToon assets that have greater bit depths than the project are resampled to the specified bit depth (e.g., in an 8-bit title, 24-bit PICTs would be "downsampled" to 8-bit). QuickTime assets are not resampled at build time, though they will display at the specified color depth unless they are set to display "Direct to Screen" (see "Direct to Screen Checkbox" on page 6.64).

Users of the built title should set their monitors to this bit-depth for the title to display properly.

- *Note: The supportsBitDepth attribute (page 15.291) can be used to check which resolutions a Macintosh monitor supports at runtime. The monitorDepth attribute (page 15.287) can be used to change the current color depth of a Macintosh monitor.*

Default Monitor
Select the project's default display monitor.

Libraries

To set the libraries preferences, select Libraries from the Show pop-up in the Project Preferences dialog (Figure 3.6). Use these preferences to specify any libraries that should be opened whenever the project is opened.

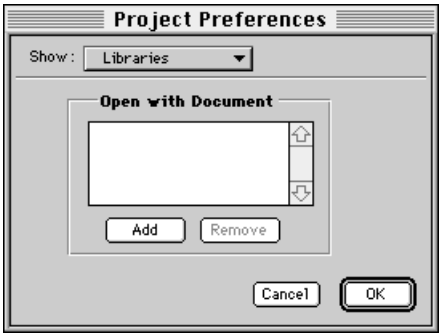


Figure 3.6 Libraries Project Preferences

Open with Document List
The library or libraries to be opened with the project are listed here.

Add Button
Click this button to display a standard file dialog. Selected libraries will be added to this list. These libraries will be opened with the project.

Remove Button
To prevent a library from opening with the project, select it from the list and click the Remove button.

Thumbnails

To set the thumbnail preferences, choose Thumbnails from the Show pop-up in the Project Preferences dialog (Figure 3.6).

Quality Radio Buttons
Select an option to display thumbnails in the project at high, medium, or low resolution.

Save Thumbnails Check Box
By default, this option is selected, allowing any media files that cannot be found when the

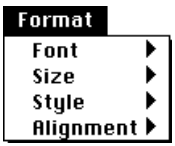
Figure 3.7 Thumbnails Project Preferences

project is opened to be replaced with their thumbnails.

Hot Tip

Toggle Save Thumbnails off to decrease the size of project files.

Chapter 4. Format Menu



Options in the Format menu can be used to edit the characteristics of text in text elements. These options are only available when text in a text element has been selected in the layout window. These formatting options are applied only to the currently selected text in a text element. Multiple formatting options can be applied to a single text element. See the discussion below for more information about how these formatting options appear in built titles.

When a text element is first created, it creates text as specified in the Application Preferences–Type dialog (see "Default Text" on page 3.49). Text formatting can be changed from this default using the Format menu options.

The text tool (the "A" icon found in the tool palette) can be used to create text elements. See "Text Tool" on page 11.104 for more information on creating text elements.

HOW mTROPOLIS HANDLES EMBEDDED FORMATTING IN TEXT ELEMENTS

Text formatting applied to portions of a text element using the Format menu options is referred to as "embedded formatting".

Though the Format menu provides a convenient way to apply formatting to a text element, the following limitations should be kept in mind:

- Embedded formatting is not supported in titles built for Windows platforms. Note, however, that embedded formatting is still useful for creating text elements if those elements will be converted to bitmaps when the project is built into a title. See "Convert Text to Bitmap Checkbox" on page 6.65. Remember that text elements that are converted to bitmaps cannot be made editable, cannot be changed via the text attribute, and cannot contain calculated fields.
- When text style modifiers (page 12.215) are applied in runtime mode, they override all embedded formatting in a text element. When text style modifiers are removed, the embedded formatting *is not* restored.
- When graphic modifiers (page 12.152) are applied in runtime mode, they override any embedded color formatting in a text element. When graphic modifiers are removed, embedded color formatting *is* restored.
- When creating text elements that will *not* be converted to bitmaps, it is best to avoid using the options in the Format menu. Use text style modifiers (page 12.215) and

graphic modifiers (page 12.152) to create the desired formatting effects. These modifiers work on both Macintosh and Windows platforms. They also work when the contents of a text element change.

Format menu options are described below.

FONT

Choose from the **Font** submenu items to change the font of highlighted text within a text element. mTropolis has access to any font currently installed on the system.

To change the font used by a section of a text element:

- Select the text tool in the tool palette. The mouse cursor changes to an insertion bar.
- Click on the text element.The insertion bar appears at the start of the text in the text element.
- Click and drag over the block of text to highlight the text to be modified.
- Choose **Font** in the Format menu. Note that the name of the font currently used by the selected text has a checkmark beside it in the **Font** submenu.
- Select a font from the submenu. The block of text changes to the specified style.
- *Note: A similar procedure is used for most of the text formatting options described in this chapter.*

SIZE

Choose from the **Size** submenu items to change the point size of highlighted text within a text element. The text in a text element can be set to one size, or blocks of text can be set to different sizes.

Font sizes are displayed in "points". There are 72 points per 1 inch. Font sizes displayed as outlined text in the **Size** submenu represent installed screen font sizes. These sizes produce a better image on-screen.

The size of currently highlighted text is indicated by a check mark beside the size in the **Size** submenu.

To change the style of text, first highlight a specific block of text within an element and choose a **Size** option from the Format menu.

STYLE

Choose items from the **Style** submenu to change the style of one or more selected text elements, or highlighted text within a text element. The text in a text element can be set to one style, or blocks of text within a text element can be set to different styles.

The style of currently highlighted text is indicated by a check mark beside the style name in the **Style** submenu.

To change the style of text, first highlight a specific block of text within an element and choose a **Style** option from the Format menu.

ALIGNMENT

Choose items from the **Alignment** submenu to align text within a text element. The options are **Left**, **Center**, or **Right** alignment. These options act on the entire contents of the text element.

The alignment of currently highlighted text is indicated by a check mark beside the alignment in the **Alignment** submenu.

To align text in a text element:

- Select the text tool in the tool palette.
- Click on the text element.
- Choose **Alignment** in the Format menu.
- Choose **Left**, **Center** or **Right** from the submenu.

EMBEDDING COLOR INFORMATION IN TEXT ELEMENTS

Though this option is not listed in the Format menu, embedded foreground colors can be applied to a text element.

To assign an embedded color in a text element:

- Select the text tool in the tool palette.
- Click on the text element.The insertion bar appears at the start of the text in the text element.
- Click and drag over the block of text to highlight the text to be modified.
- Select a foreground color from the tool palette's color swatch. See "Foreground and Background Colors" on page 11.109.
- The color of the selected text is changed.

DELETING AND EDITING TEXT

To delete text within an element:

- Select the text tool in the tool palette.
- Click and drag over a block of text to select it.
- Press the Delete key (or select **Cut** from the Edit menu). The text is cleared from the text element. Its frame and modifiers remain intact.

CALCULATED FIELDS—DISPLAYING VARIABLES IN TEXT FIELDS

A text element can be configured to display the contents of a variable during runtime. Whenever the field receives the *Update Calculated Fields* command, the contents of the field update to display the current value of the variable. Use the following technique:

- Create a text element that contains the name of the variable to be displayed enclosed in < and > symbols as follows:

  ```
  <variablename>
  ```

  The fields of compound variables can be displayed by using the same syntax used to access them in Miniscript. Use a period to separate the variable name from the desired field as follows:

  ```
  <variable.field>
  ```

  Multiple values can be displayed by enclosing the name of each variable in its own < > symbols. Variable names can also be mixed with regular text.

For example, to display a string variable named `user` that contains a user's name and an integer variable named `score` that contains the user's game score, the following text element entry could be used:

```
<user> current score is: <score>
```

- The variables to be displayed must be within the scope of the text element (i.e., they must be located on or somewhere above the text element in the structural hierarchy).

  Continuing our example, the `user` and `score` variables might be placed on the scene.

- In runtime mode, the initial values contained in the specified variables are substituted in place of the < > enclosed variable names. For example, upon switching to runtime mode, our text element might now show:

  ```
  Keith current score is: 1005
  ```

- To update the text element to display the current contents of the specified variables, use a messenger to send the *Update Calculated Fields* command to the text element. See "Update Calculated Fields (Message/Command Menu Only)" on page 13.235. The text element updates to show the new values of the specified variables.

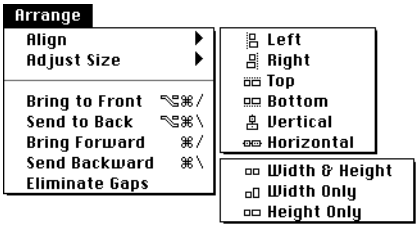
- *Note: Even though the visible contents of a calculated field change, the text element's text attribute does not update. It continues to contain the original syntax used to define the calculated field. Continuing our example, the user sees "Keith current score is: 1005", but the string contained in the text element's text attribute is still "<user> current score is: <score>".*

Special Variables for Display in Calculated Fields

There are five special variables that can be displayed in calculated fields:

- **<time>**: Displays the current system time in hour:minute AM/PM style (e.g., 7:15 PM).
- **<long time>**: Displays the current system time in hour:minute:second AM/PM style (e.g., 7:15:23 PM).
- **<date>**: Displays the current system date in month/day/year style (e.g., 12/4/96).
- **<long date>**: Displays the current system date in Weekday, Month Day, Year style (e.g., Thursday, April 25, 1996).
- **<abbrev date>**: Displays the current system date in abbreviated Weekday, Month Day, Year style (e.g., Thu, Apr 25, 1996).

Chapter 5. Arrange Menu



The Arrange menu provides options for aligning graphic and text elements along a specified edge, and for giving elements a common size. Options used to change an element's layer order, and to eliminate any gaps that have been created in the layer order, are also available in this menu.

Features of the Arrange menu are described below.

ALIGNING ELEMENTS

Choose **Align** to line up two or more selected elements along a specified edge. The alignment options are **Left**, **Right**, **Top**, **Bottom**, **Vertical,** and **Horizontal.** Objects are aligned to the specified edge of the first selected element.

To align elements:

- Choose the selection tool in the tool palette.
- Shift-Click to select the elements to be aligned, or drag a marquee around the elements.
- Choose an alignment option from the **Align** submenu. The elements align along the edge of the first selected element.

ADJUSTING THE SIZE OF ELEMENTS

Choose from the Arrange menu's **Adjust Size** submenu to give two or more selected elements a common size. The sizing options are:

- **Width & Height**: both the widths and heights of elements change to the width and height of the largest selected element.
- **Width Only**: the widths of the elements change to the width of the largest selected element.
- **Height Only**: the heights of the elements change to the height of the largest selected element.

To give elements a common size:

- Select the selection tool in the tool palette.
- Shift-Click to select the elements to be resized, or drag a marquee around the elements.
- Choose an adjustment option from the **Adjust Size** submenu.

CHANGING THE LAYER ORDER OF ELEMENTS

The layer order of text and graphic elements is the order in which the elements are drawn on

the screen. When new elements are added to a scene, they draw on top of previous elements. Drawing elements on top of each other creates the illusion that the two-dimensional (X,Y) screen has a depth (Z) dimension (Figure 5.1). The effect is popularly called "2.5D."

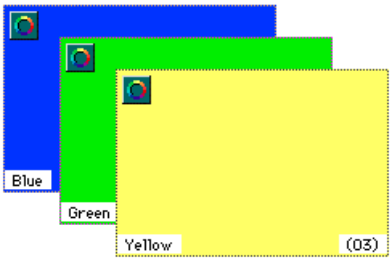


Figure 5.1 The effect of graphic layers

In the layout window, the layer order of an element is represented by a number in parentheses shown on the bottom right corner of the element. The higher the number, the closer it appears to the viewer (Figure 5.1).

Options in the Arrange menu provide a quick and easy way of changing the position of a single element within the layer order, or moving an element to the back or front of the layer order. These options are described below.

Changing the Layer Order of Single Elements

The Arrange menu layer ordering options produce the following effects when applied to single elements:

- **Bring to Front** (⌘-Option-\): The selected element is moved to the top of the layer order. It will draw on top of the other elements.
- **Send to Back** (⌘-Option-/): The selected element is moved to the bottom of the layer order. The element will draw underneath all other elements.
- **Bring Forward** (⌘-\): The selected element is moved one position up in the layer order.
- **Send Backward** (⌘-/): The selected element is moved one position down in the layer order.

To move an element in the layer order:

- Click on the selection tool in the tool palette.
- Select the element to be moved.
- Choose an item from the Arrange menu. The selected element is moved in the layer order and its layer order number is updated.

Changing the Layer Order of Multiple Elements

Applied to multiple elements, the Arrange menu layer ordering options produce the following effects:

- **Bring To Front** or **Send To Back**: Selected multiple elements can be moved using the Bring to Front/Send to Back commands. They retain their relative order when placed.

  When using the **Bring To Front** command, any existing gaps between the selected

elements are eliminated when they are placed.

When using the **Send to Back** command, any existing gaps between the selected elements are retained when they are placed. If there are insufficient spaces to accommodate the number of elements being moved, existing elements are automatically moved forward the appropriate number of spaces in the layer order.

These commands are not available if all elements in a scene are selected, a scene is selected, or if no elements have been selected.

- **Bring Forward** or **Send Backward**: Used with multiply selected items, **Bring Forward** moves the selected elements one layer forward in the layer order. The **Send Backward** command moves the selected elements one layer backward in the layer order. Any existing gaps among the selected elements are eliminated when they are placed.

  If there is an element in front of or behind the elements to be moved, their positions are swapped. For example, when elements whose layer order numbers are 1, 2, 3 are moved forward one layer, the element previously in position 4 will be moved to layer number 1.

Additional Notes about Layer Ordering

Layer order numbers begin with the scene. The layer order number of a scene is "00" and cannot be changed.

All the layer order editing options in the Arrange menu can be used in any window.

The layer order can also be changed by editing the element's layer order number in the Element Info dialog, by using the editing options in the layers window, or by using the object info palette.

ELIMINATING GAPS IN THE LAYER ORDER

The **Eliminate Gaps** Arrange menu item can be used to remove unused layers between elements in a scene.

During the process of creating elements and changing their layer orders, gaps in their numbering sequence may be created. At times these gaps may be useful. For example, an author may deliberately leave gaps between elements on a shared scene to accommodate other elements that will appear there during runtime.

On the other hand, unnecessary gaps can add to the amount of scrolling required to view elements in the layers window. These gaps can be removed using the **Eliminate Gaps** menu item.

To eliminate gaps in the layout or layers window:

- Select the scene and choose **Eliminate Gaps** from the Arrange menu. The gaps are eliminated and the layer order of all elements within the scene is changed.

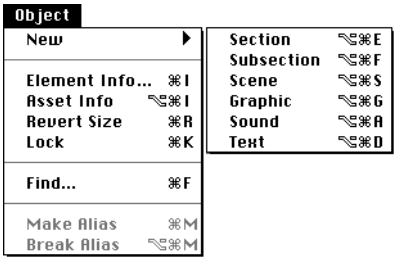
Gaps can also be eliminated between specifically selected elements in any view.

To eliminate specific gaps:

- Hold down the Shift key and select the elements. Choose **Eliminate Gaps** from the Arrange menu. The layer gaps between the selected elements are eliminated and the layer order of the elements is changed.

Eliminating Gaps in the Layer Order

Chapter 6. Object Menu



The Object menu contains options for creating and managing project components.

- The first section of the menu contains commands for creating new project components. These options can be used in any editing view (except for **New-Sound**, which can only be used in the structure view).
- The second section of the menu contains commands for obtaining information about, resizing, and locking project components.
- The **Find** option can be used to find project components based on many different search criteria.
- The last section of the menu contains an option for creating modifiers that share the same settings (**Make Alias**) and another that removes this functionality (**Break Alias**).

Object menu options are described in detail below.

ADDING SECTIONS, SUBSECTIONS, SCENES AND ELEMENTS TO A PROJECT

A mTropolis project has a structural hierarchy that begins at the project level, and descends through sections, subsections, scenes and elements (Figure 6.1). Modifiers can be added to any level in the project's hierarchy.

The **New-Section (⌘-Option-E)**, **New-Subsection (⌘-Option-F)**, **New-Scene (⌘-Option-S)**, **New-Graphic (⌘-Option-G)**, **New-Sound** (**⌘-Option-A**, available only when a component is selected in the *structure* view) and **New-Text (⌘-Option-D)** menu items in the Object

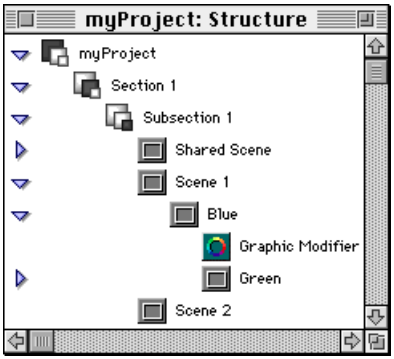


Figure 6.1 Structural view of a project hierarchy

menu provide a quick and convenient way to add a new component to a project while working in one of mTropolis' three editing views.

See Chapter 8, "Structure Window", Chapter 9, "Layout Window", or Chapter 10, "Layers Window" for information on using Object menu items to add components to a project in these views.

THE ELEMENT INFO DIALOG

The **Element Info** option (⌘-I) in the Object menu opens a selected element's Element Info dialog (Figure 6.2). This dialog is used to set the initial states of graphic, sound and text elements. The Element Info dialog can also be opened by double-clicking on the element. See "Tool Palette" on page 11.103 for complete information on creating elements.

- *Note: If this option is chosen when a Section element is selected, the Section Info dialog appears. See "Assigning Sections to Title Segments" on page 2.39.*

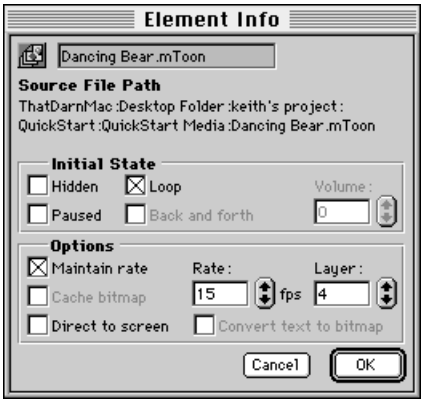


Figure 6.2 The Element Info dialog shown here for an mToon element

Controls in the Element Info dialog are described below. Note that options in the Element Info dialog vary according to the type of media that has been linked to the selected element. Not all fields are available in all Element Info dialogs.

Element Type Icon

These icons identify the element's type:


A graphic element that has not been linked to media.


A graphic element that has been linked to a PICT.


A graphic element that has been linked to an mToon, mTropolis' proprietary animation format.


A graphic element linked to a QuickTime movie.


A text element.


A sound element.

Element Name Field

By default, the name of the linked external media appears in this text field. A new name for the element can be entered without changing the name of the external media file.

Source File Path

This area displays the location of external media that has been linked to the element.

Hidden Checkbox
Select Hidden to initially hide an element during runtime. The element can be made visible by sending it a *Show* or *Play* command (see "Shown/Show" on page 13.234 and "Played/Play" on page 13.238). Hidden elements do not respond to user mouse clicks, as described in "How mTropolis Generates Mouse Messages" on page 13.231

Loop Checkbox
By default, movies and mToons will loop (i.e., play continuously). Uncheck this option to have them play only once.

Paused Checkbox
The Paused checkbox is specific to movies, mToons and sounds. Choose Paused to initially pause a video, mToon or sound at runtime. Paused movies and mToons display their first frame, but do not continue playing until told to do so. Similarly, paused sounds do not play until told to do so. Elements can be made to "unpause" by sending them a *Play, Unpause* or *Toggle Pause* command. See "Played/Play" on page 13.238, "Unpaused/ Unpause" on page 13.240, and "Toggle Pause (Message/Command Menu Only)" on page 13.240.

Back & Forth Checkbox
When selected, this option allows video files and mToons to play back and forth between their start and end positions.

Volume Field
Set the initial volume level of a sound or QuickTime element to a percentage of the sound file's original volume. Volume levels can also be accessed by messengers and by Miniscript.

Play Every Frame Checkbox
When checked, this option forces playback of every frame of a QuickTime movie. Usually, QuickTime movies drop frames to ensure proper synchronization between the video and audio portions. However, for movies without sound, this checkbox can be selected to ensure that the movie's playback speed is adjusted to the speed of the system.

Maintain Rate
Unlike QuickTime movies, which may drop frames to match their specified frame rate, mToons always show all of their cels. This mToon option, checked by default, controls the way in which an mToon plays its cels:

- When this option is checked, the length of time that each cel in the mToon is actually displayed on screen may vary as the mToon attempts to play at the frame rate specified in the Rate field. On slower machines, this behavior may cause an mToon to play unevenly as the frames slow down when the system is busy then rapidly speed up to attempt to match the designated frame rate.
- When this option is not checked, mTropolis attempts to make the length of time that each cel is displayed on screen constant. As a result, the mToon may not be able to maintain the specified frame rate, but the animation's speed will appear consistent. This behavior is useful when the display of each cel for a consistent duration

is more important than the overall frame rate.

Cache Bitmap Checkbox
Checking Cache Bitmap stores an element's contents in memory as a bitmap graphic, optimizing screen redraw time.

This option can be useful when ink or image effects have been applied to an image. For example, gradient effects require significant processing time to be produced. An element that contains a gradient modifier (set to apply itself on Parent Enabled or Scene Started) with the Cache Bitmap checkbox option selected will be stored in memory—with the effect already applied—where it can be accessed as required, greatly decreasing processing time.

This option is the default for text elements. When this option is checked, text elements are rendered to a bitmap during runtime and that bitmap is used to display the text. The bitmap is updated only when the text changes. In most cases, this option results in the most versatile and fastest display of text.

However, if a text element contains more text than the element can display at one time, scrolling the text element by sending it one of the "Scroll" commands (described on page 13.235) will not reveal more text. The cached bitmap contains an image of only the originally visible text. Unchecking the cache bitmap option causes the text element to be refreshed each time it receives a scroll command, revealing previously-hidden text.

When text is not cached, not all ink effects are supported. On Macintosh, un-cached text can only have the "Copy" ink effect applied. On Windows, un-cached text can have only the "Copy" or "Background Transparent" ink effect applied.

- *Note: This option is limited by the memory available to the application in runtime mode.*

Direct to Screen Checkbox
By default, elements are drawn in a layer order, creating a "2.5D" effect. Checking the Direct to Screen option improves element redraw time by drawing an element on top of other elements in a scene. The element is no longer part of the mTropolis layer order. When set to play direct to screen, an element's layer order number is shown in square brackets in the Layout window (e.g., `[01]`) instead of the usual parentheses (e.g., `(01)`).

The "Direct to Screen" option is a performance optimization that fundamentally changes the way an element displays on screen. Results may not always be pleasing. For example, draggable elements displayed direct to screen may exhibit "flashing" or other updating problems when they are dragged. mToons that contain cels of different sizes may display "trails" as they play. Some ink effects may not work properly with this option enabled. Such "problems" are side-effects of the direct to screen behavior.

This option is most useful for movies and mToons that simply play in one place without moving and without having other elements move over or under them.

- *Note: QuickTime VR movies are always drawn direct to screen.*

Layer Field
Change the layer order number of an element by entering a new number here. See "Changing the Layer Order of Elements" on page 5.57 for more information on mTropolis layers.

Rate Field
Specify the desired play rate of an mToon, in frames per second, by entering a value here. Optionally, use the arrow keys to change the value. The default value is 15 frames per second.

Convert Text to Bitmap Checkbox
Check this box to convert a text element to a bitmap when the project is built into a title (see "Build Title" on page 2.39). The "text" becomes a bitmap "picture" of the text and behaves exactly like a PICT element. Hence, machines that run the title do not need to have installed the fonts that are used in this text element and all embedded formatting is preserved. This option is useful for cross-platform applications where the font used in the text element is not available on all platforms.

Text converted to a bitmap cannot be changed during runtime mode. The following restrictions apply to text elements that have this option enabled:

- They do not have a "text" attribute. The contents of the element cannot be read or written. In addition, they do not have other text-specific attributes such as "clickedLine" and "lineCount".
- They cannot be made editable. Sending them the *Enable Editing* command has no effect. They do not have an "editable" attribute.
- They cannot be used as "calculated fields" to display mTropolis variables.
- If the text element contains more text than the element can display at one time, scrolling the text element by sending it one of the "Scroll" commands (described on page 13.235) will not reveal more text. The converted bitmap contains an image of only the originally visible text.

Depending upon the types of effects applied to text elements, they may be written as either 1-bit or 8-bit bitmaps when built into a title. One-bit bitmaps take very little space to store in a title (i.e., about the same space as a regular text element). Eight-bit bitmaps use significantly more space in a title file.

The text element will be converted to a 1-bit bitmap in the following situations:

- When the text element has a graphic modifier applied to it. A single foreground and background color are applied over the entire element.
- When the text element has a text style modifier applied to it.
- If no text style or graphic modifiers are applied to the element, and the entire text element uses black as the text color.

The text element is converted to an 8-bit bitmap when the text element contains no text

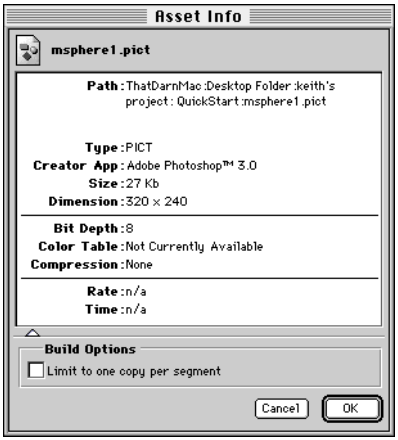


Figure 6.3 The Asset Info dialog

style or graphic modifiers *and* embedded formatting has been used to change the color of any part of the text to a color other than black. See Chapter 4, "Format Menu" for more information about embedded formats.

OK Button

Click OK to save the settings and close the dialog.

Cancel Button

Click Cancel to close the dialog without making any changes.

ASSET INFO

Select **Asset Info** from the Object menu (or press **⌘-Option-I**) to display general information about the asset linked to the currently-selected element. The Asset Info dialog (Figure 6.3) appears.

Build Options Section

Click the triangle at the bottom of the Asset Info dialog to display the Build Options section of the dialog.

The "Limit to one copy per segment" checkbox in this section can be used to modify the way the asset is written when the project is built into a title. By default, assets are written as specified by the option selected in the Build Title dialog's Asset Order pop-up menu (page 2.39). When this checkbox is checked, the asset is included only once in the first title segment in which it is used. This option is useful for including a large asset only once in a built title. Note that this option takes effect only when the "Build for Speed" build title option is selected. In titles built using the "Build for Space" option, all assets are only written once, so this option becomes redundant.

REVERT SIZE

Choose **Revert Size** from the Object menu (or use ⌘-R) to resize selected elements to the original dimensions of their linked external media.

LOCK

Choose **Lock** from the Object menu (or use ⌘-K) to prevent a selected element from being moved with the mouse while in edit mode.

When an element is locked it cannot be resized, or moved with the mouse. Media cannot be linked to an element that is locked. All other functions and capabilities of an element remain intact while it is locked.

Figure 6.4 The Find dialog

Elements can always be deleted by pressing the "Delete" key or by selecting **Clear** from the Edit menu, even when they are locked.

- *Note: By default, scenes are locked when they are first created. Also, media can be linked to scenes using the **Link Media-File** option, even when they are locked. However, other methods of changing media associated with the scene element (e.g., dragging from the Asset palette) do not work when the scene is locked.*

To lock an element while in edit mode:

- Select an element to be locked.
- Choose **Lock** from the Object menu (or use ⌘-K). The element is now locked.

To unlock an element while in edit mode:

- Select a locked element.
- Choose **Lock** from the Object menu (or use ⌘-K). The element is unlocked.

FIND

Select **Find** from the Object menu to search for components in a project by name. The Find dialog appears (Figure 6.4). Components of the Find dialog are described below.

Find Items In

Use the pop-ups in this section to define the portion of the project to search. Individual sections, subsections, and scenes can be specified. The default is to search in the entire project.

Whose Section

Use the pop-ups in this section to define search criteria. The leftmost pop-up defines the type of search to perform. Options include **Name**, **Asset**, and **Alias**:

- Select **Name** (the default) to search for a project component based on characters in the component's name. Enter the string to be searched for in the rightmost pop-up. Alternatively, drag an element from the project and drop it in the rightmost pop-up—the pop-up changes to reflect the dropped element's name. The middle pop-up can be used to select the conditions under which the string will be found. Options include **Contains** (the default), **Starts with**, **Ends with**, **Is**, **Is not**, and **Doesn't** contain. Click the "Find" button to start the search.

- Select **Asset** to search for project components that make use of a specified asset (including modifiers that "link" to assets, such as the sound effect modifier and color table modifier). The middle pop-up changes to "Is" (the only choice for this type of search). The rightmost pop-up changes to "Drop asset here". Drag an asset from the Asset Palette and drop it on the rightmost pop-up menu. Select the "Find" button to start the search.
- Select **Alias** to search for copies of a specified alias. This option is useful because individual copies of an alias used in a project can be given unique names. Thus, it may not be obvious from the editing views which aliases are copies of the same master. The middle pop-up changes to "Is" (the only choice for this type of search). The rightmost pop-up changes to "Drop alias here". Drag an alias from the project and drop it on the rightmost pop-up menu. Select the "Find" button to start the search.

Find Button

Select **Find** to start the search. If items are found, they are shown in the Items Found window.

Items Found Window

The Items Found window (Figure 6.5) displays items located by a find operation. The top portion of the window shows a list of found items and their icons in alphabetical order. Select an item to see its location in the lower portion of the Items Found window.

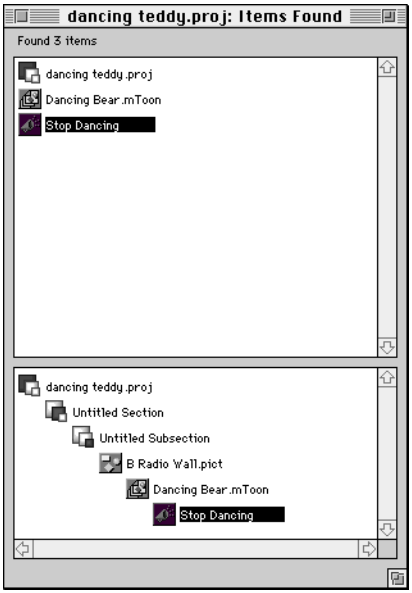


Figure 6.5 The Items Found window

The lower portion of the Items Found window shows the path of the found item selected in the top portion. Double-click the found item to make all open windows in the project "sync" to its location. The item will be selected in the project. If the found item exists in a palette (e.g., the alias or asset palette), the palette is displayed and scrolled to the location of the found item.

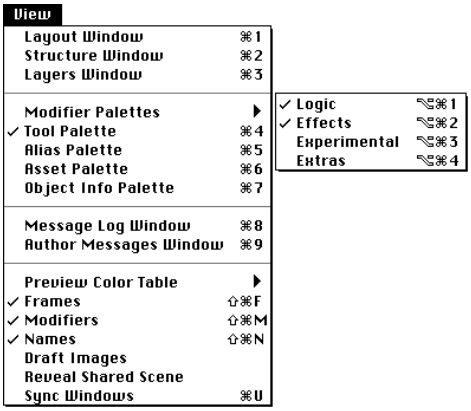
MAKE AND BREAK ALIAS

The **Make Alias** option in the Object menu (or ⌘-M) turns a selected modifier into an alias. An alias is a productivity tool that is used to more easily manage modifiers with identical settings. The **Break Alias** option breaks the relationship between an instance of an alias and

the master copy of the alias. Aliases reside on the alias palette, which can be viewed by selecting **Alias Palette** from the View menu. See "Alias Palette" on page 11.110 for a complete description of aliases, the alias palette, and the **Make Alias** and **Break Alias** options (see "Creating Aliases" on page 11.111 and "To "break" an alias:" on page 11.112).

Make and Break Alias

Chapter 7. View Menu



The View menu contains options for configuring the view of the project in edit mode.

mTropolis has three editing views: the *layout* window, the *structure* window, and the *layers* window. The options in the first part of the menu allow switching between these three views. Although editing views are discussed briefly in this chapter, they are described in detail in the following chapters:

- Chapter 8, “Structure Window”
- Chapter 9, “Layout Window”
- Chapter 10, “Layers Window”

The palettes listed in the second part of the menu contain tools for editing elements and modifiers. They are described in Chapter 11, “Palette Reference”. The modifier palettes are described in Chapter 12, “Modifier Reference”.

The Message Log window can be accessed from the View menu. This window displays the messages and commands that have been sent and received between components during runtime.

The View menu also contains options for altering the view of the current scenes in the layout and layers windows.

SELECTING AN EDITING VIEW

mTropolis’ layout, structure and layers windows provide three different ways of viewing and editing a project.

- The layout window provides a WYSIWYG (what you see is what you get) view of the project on a per scene basis. It is the best view for laying out graphic and text elements on the screen. See Chapter 9, “Layout Window”, for more information on this view.
- The structure window is used primarily for altering the structure of the project. New sections, subsections, scenes, elements, or modifiers can be added to the structure, deleted, or rearranged. Some authors prefer to begin a project by building its structure in the structure window. Elements or

modifiers that span scenes, especially sound elements, can be added and edited in this view. See Chapter 8, "Structure Window", for more information on this view.

- The layers window can be used to edit the elements and scenes in a subsection. The order of a subsection's scenes can be changed and the layer order of each scene's elements can be edited. New elements can also be added and configured with modifiers in this view. See Chapter 10, "Layers Window", for more information on this view.

To open the view windows:

- Choose **Layout Window** from the View menu (or use ⌘-1).
- Choose **Structure Window** from the View menu (or use ⌘-2).
- Choose **Layers Window** from the View menu (or use ⌘-3).

Any of these windows can be closed by clicking the close box in the window's title bar.

Working with the Three Views

All three views can be on the screen at once, but only one view can be active at a time. The currently active view is highlighted. Click on a view window to make it active.

Copying and Pasting between Projects

Items in a view in one project can be copied and pasted into any view in another project. For example, an entire scene could be copied from the *layout* view in one project and pasted into the *structure* view in a second project. Similarly, an element and its modifiers could be copied from the layers view of one project and pasted into the layers view of a second project.

To copy components from one project to another:

- Open both projects.
- Select a view in the first project.
- Click on the item (or items) to be copied.
- Choose **Copy** from the Edit menu (or use ⌘-C).
- Select a view in the second project.
- Select a destination in the second project's view.
- Choose **Paste** from the Edit menu (or use ⌘-V) while the second project is still selected. The item appears in the second project.
- *Note: With the exception of "project" icons, any component can also be copied into another project by simply dragging and dropping it onto a destination in the new project.*

WORKING WITH PALETTES

Palettes can be opened by selecting their corresponding menu options from the View menu or by pressing the command keys shown below:

- **Modifier Palettes-Logic** (⌘-Option-1). For a complete description of this palette, see “Modifier Palettes” on page 11.109.
- **Modifier Palettes-Effects** (⌘-Option-2). For a complete description of this palette, see “Modifier Palettes” on page 11.109.
- **Modifier Palettes-Extras**. For a complete description of this palette, see “Modifier Palettes” on page 11.109.
- **Tool Palette** (⌘-4). For a complete description of this palette, see “Tool Palette” on page 11.103.
- **Alias Palette** (⌘-5). For a complete description of this palette, see “Alias Palette” on page 11.110.
- **Asset Palette** (⌘-6). For a complete description of this palette, see “Asset Palette” on page 11.112.
- **Object Info Palette** (⌘-7). For a complete description of this palette, see “Object Info Palette” on page 11.115.

MESSAGE LOG WINDOW

The message log window (Figure 7.1) displays the messages and commands that have been sent and received between components during runtime. It also displays various error messages that may be generated during runtime. This window is useful for debugging mTropolis projects.

To display this window, choose **Message Log Window** from the View menu (or use ⌘-8).

Check the window’s **Enable Logging** checkbox to display information about the messages generated during runtime mode upon returning to edit mode. Note that the Message Log window also acts as an error log. Even if logging is not enabled, this window is automatically displayed when an error occurs

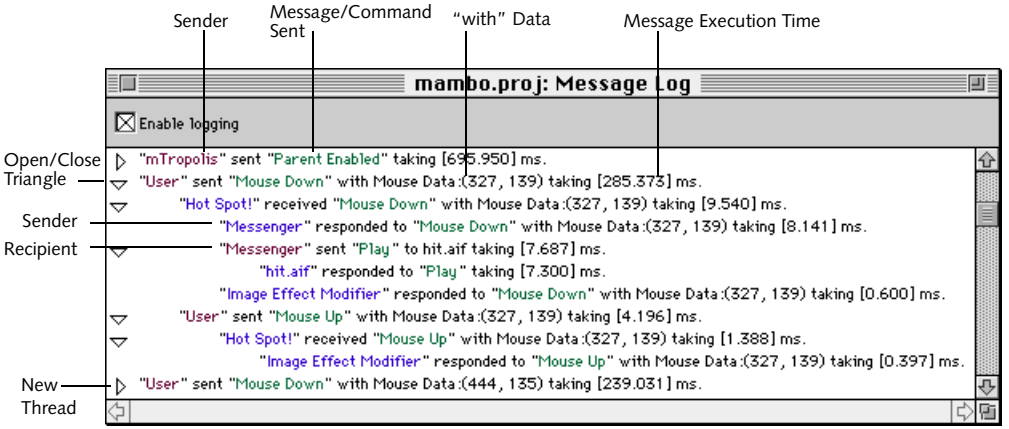


Figure 7.1 A Message Log window

during runtime. The text of the error message is displayed in the Message Log window.

The Message Log displayed in Figure 7.1 shows those components that have received and responded to a number of mouse messages.

Components of the message log window are described below.

Sender
On color monitors, senders of messages and commands are displayed in red.

Message/Command Sent
Messages and commands that are passed between objects are displayed in green.

Recipient
Recipients of messages or commands are displayed in purple.

Enable Logging Checkbox
Check **Enable Logging** to display the path of messages and commands that have been passed to selected components during runtime execution. See "Selecting Messages and Commands to be Displayed by the Message Log Window" on page 7.74.

New Thread
Each new thread of messages is indicated by a left-aligned message. Lines of text "cascade" to the right, as messages and commands are passed to each new object in the project.

Open and Close Triangles
Click these arrows to show and hide the message path generated by each sender and recipient. Option-Click a triangle to open/close it and all other triangles it contains.

Aligned Messages
Recipients that share the same parent are vertically aligned.

Message Execution Time
The time it takes for each message to execute is also displayed in the Message Log window. Total execution time is displayed for each new message thread. A time is also displayed for each point in the message path. This time shows how long it takes the receiver to process or respond to the message. The total of those times, plus some immeasurable bits of time, equals the total execution time. Note that the actual numbers rarely add exactly—a certain amount of processor overhead results in small discrepancies.

Time display is useful for message log profiling and message execution optimization. It is possible to track how long a message is taking to execute, or to analyze specific points in the message path for optimal performance.

Selecting Messages and Commands to be Displayed by the Message Log Window

When the message log window's **Enable Logging** checkbox is checked, buttons appear to the far left of each component shown in the *structure* window (Figure 7.2). By default, these buttons are de-selected and look like flattened circles. Click a button to toggle message logging for the component that button is aligned with. The button expands into a "ball" to indicate that logging is enabled.

After a runtime execution, the messages and commands that have been passed to the

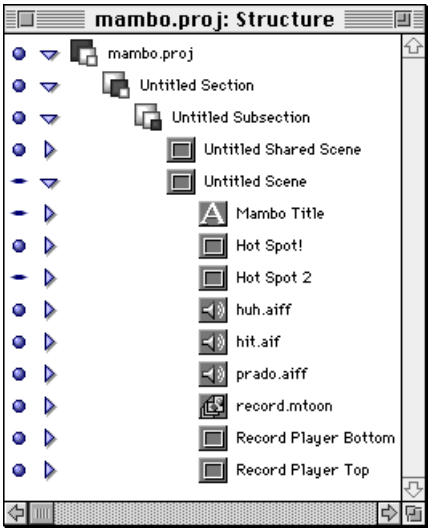


Figure 7.2 Selecting messages to be logged. In this example, "Hot Spot!" has its logging button enabled while "Mambo Title" does not.

selected components appear in the message log window.

Error Messages

The Message Log Window displays certain types of error messages generated by mTropolis. Even if logging is not enabled, the Message Log Window is automatically displayed (upon returning to edit mode) when an error occurs during runtime.

Short descriptions of each error message can be found below.

- *Note: Custom error or notification messages can be sent to the Message Log Window using the debug variable. See "The Debug Variable" on page 14.269.*

Data Conversion Error Messages

The following error messages are displayed when a variable can't be converted to the desired data type:

- **Can't make floating-point**
- **Can't make integer**
- **Can't make boolean**
- **Can't make point**
- **Can't make vector**
- **Can't make range**
- **Can't make list**
- **Can't make string**

List Error

The following error message applies to the list variable modifier:

- **Index out of range.** An attempt was made to subscript a value outside the range from 1 to the number of elements in the list.

Math Error Messages

The following error messages are displayed when an illegal math operation has been attempted:

- **Can't add.** An addition operation was attempted on data types that cannot be added.
- **Can't subtract.** A subtraction operation was attempted on data types that cannot be subtracted.

- **Can't multiply.** A multiplication operation was attempted on data types that cannot be multiplied.
- **Can't divide.** A division operation was attempted on data types that cannot be divided.
- **Can't negate.** A negation operation was attempted on data types that cannot be negated.
- **Zero division error.** A division operation was attempted with a denominator of zero.
- **Can't compare these.** A relational operation was attempted on data types that can't be compared.
- **Can't do boolean operation.** A boolean operation was attempted on inappropriate data types.

Object-Related Error Messages

The following error messages only apply to elements and modifiers:

- **Can't find element.** The referenced element can't be found. Check if the element has been renamed or deleted.
- **Can't find mod.** The referenced modifier can't be found. Check if the modifier has been moved or deleted.
- **Can't get *attribute* of *element*.** An attempt was made to get an attribute that does not exist or apply to the element.
- **Can't set *attribute* of *element*.** An attempt was made to set an attribute that does not exist or apply to the element.
- **Text: Incompatible setting.** An attempt was made to alter or make editable a text element that was converted to a bitmap. Text elements are converted to bitmaps when the 'Convert text to bitmap' option is checked in the Element Info Dialog.
- **Bad target for send message.** Messages can only be sent to elements and modifiers. Check message target.

Other Miniscript Error Messages

The following error messages relate to more generic scripting errors:

- **Stack overflow.** The referenced expression is too complex.
- **No code.** The referenced Miniscript modifier contains no written script.
- **Function error.** A generic function error has occurred. Check that function syntax is correct.

Other mTropolis Error Messages

The following error messages relate to more generic system and message errors:

- **Message thread too deep.** The message thread queue is overloaded. To avoid overloading the queue, turn off the "Immediate" checkbox in the "Message Options" section of the messenger modifier's configuration dialog. When this checkbox is disabled, the messenger will only send messages once the current thread has ended.

AUTHOR MESSAGES WINDOW

Select **Author Messages Window** from the View menu to display the Author Messages window (Figure 7.3).

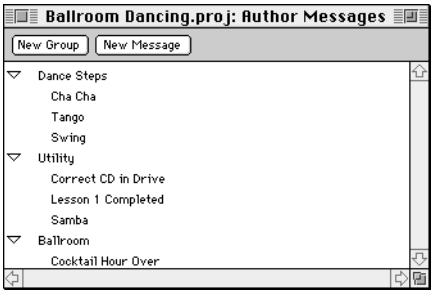


Figure 7.3 The Author Messages window

Author messages are one way to activate modifiers. They can be created using the Message and Message/Command pop-ups in modifier dialogs, or in the Author Messages window. See "Author Messages" on page 13.230 for a complete description.

The Author Messages window can be used to create and manage author messages from a central location. Author messages can be created, edited, deleted or placed in groups from this window. Controls for this window are described below.

New Message Button
Click on this button to create a new author message. An untitled message appears in the Author Messages window.

Once created, a new author message appears as an item in the Author Messages window and as a submenu item under Author Messages in each modifier's When pop-up or Message/Command pop-up.

New Group Button
Click on this button to create an untitled author message group. An untitled group appears in the Author Messages window.

Once created, a new group appears as an item in the Author Messages window and as a submenu item under Author Messages in each modifier's When pop-up or Message/Command pop-up. This feature can be used to group sets of related author messages together.

- *Note: Author message groups can contain both author messages and other author message groups.*

Open and Close Triangle
To expand or collapse the contents of author message groups, click their triangles.

To delete author messages:
- Select either an author message or a group from the list and press the **Delete** key.
- *Note: Deleting an author message from the window deletes the author message from the list but does not delete occurrences of this message in the project. The author message is no longer available from the Message/Command pop-up. However, if that author message was previously selected in a modifier dialog, that modifier will continue to send or listen for the author message until its dialog is opened and reconfigured.*

To edit or rename messages and groups:
- To edit the name of an author message or to rename a group, double-click its name in

the Author Messages window and enter a new name.

To move author messages and groups into new groups:
Standard drag and drop methods can be used to move items in the Author Messages window.

- Select the author message or group to be moved and drag it to a new group. An outline of the dragged object appears.
- Drag the object to its destination. When the targeted destination group highlights, release the mouse button. Figure 7.4 illustrates this process.

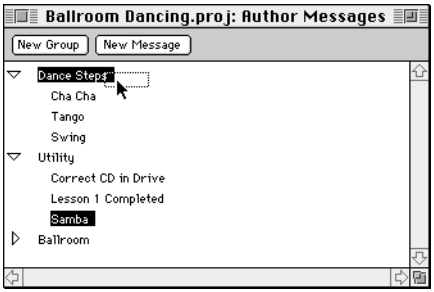


Figure 7.4 Moving an author message to a new group. Here, the author message "Samba" is being moved from the "Utility" group to the "Dance Steps" group.

To reorder author messages in the dialog:
- Select the author message to be moved and drag it to a new location. A dotted, horizontal insertion bar appears between items, indicating where the item will appear when dropped.

USING VIEW MENU OPTIONS IN EDIT MODE

The last set of View menu items control the appearance of the *layout* and *layers* views. The menu items described below can be used to remove visual clutter from the editing view, or to simulate the view of the project in runtime.

Preview Color Table

Select a color table name from this cascading menu to see the effect of a color table (that has been previously linked to the project) during edit mode. Select **Macintosh 8bit** to return the display to its default color scheme. Regardless of the setting in this menu, color table modifiers show their effects when they are activated in runtime mode (see "Color Table Modifier" on page 12.141).

Frames

The **Frames** menu toggle can be used to show and hide the frames around elements. Select **Frames** from the View menu (or press ⌘-Shift-F). The default is on.

When **Frames** is toggled off, both the **Modifiers** and **Names** options are also automatically turned off. These items will appear greyed out in the View menu.

When **Frames** is toggled on, the **Modifiers** or **Names** options are also automatically turned on. These options can then be toggled individually.

Modifiers

To hide or show the modifier and behavior icons on elements (in the layout or layers

windows only—the structure view always shows modifiers), use the **Modifiers** menu toggle in the View menu (or press ⌘-Shift-M). The default is on.

- *Note: This option is not available when* **Frames** *is toggled off.*

Names

To hide or show element names, use the **Names** menu toggle in the View menu (or press ⌘-Shift-N). The default is on.

- *Note: This option is not available when* **Frames** *is toggled off.*

Draft Images

Use the **Draft Images** menu toggle to switch between low- and high-resolution displays of a project's media. When **Draft Images** is toggled on, screen redraw time is reduced, which is especially useful when stepping through scenes in a project in the layout window. This option is also useful when using a less powerful computer for project development. The default is off.

Reveal Shared Scene

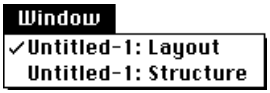
Use the **Reveal Shared Scene** menu toggle to show or hide the shared scene with the scene currently displayed in the layout window. The default is off. When this option is on, the scene appears as it would during runtime.

Sync Windows

Choose **Sync Windows** (or use ⌘-U) to make the selected component of one window visible in all other editing windows.

WINDOW MENU OPTIONS

The Window menu displays a list of the editing windows that are currently open. Windows are listed by project name and then window name. Select an item from the menu to make that window the active one. A checkmark appears next to the name of the active window.



Chapter 8. Structure Window

This chapter provides information on working in the structure window, one of mTropolis' three editing views. The other views are described in Chapter 9, "Layout Window", and Chapter 10, "Layers Window".

To open the structure window:

- Choose **Structure Window** from the View menu (or use ⌘-2). The structure window appears as the active window.

All three editing windows can be open at once. Any of the open windows can be made active by clicking on them. Optionally, use the window's corresponding keyboard command to display it or make it active: Layout Window: ⌘-1, Structure Window: ⌘-2, Layers Window: ⌘-3.

STRUCTURE WINDOW OVERVIEW

mTropolis' projects have a hierarchical structure. The highest level of the structure is the project itself. The hierarchy then descends to sections, subsections, scenes and finally to elements. Modifiers can be placed anywhere in the structure hierarchy.

The expanded view of a default project in the structure window (Figure 8.1) reflects this hierarchy. Components of the structure window are described below.

Element Levels

Each kind of element in the project's hierarchy is shown on its own indented position. The default view of a project shows four levels of elements: project, section, subsection and scene.

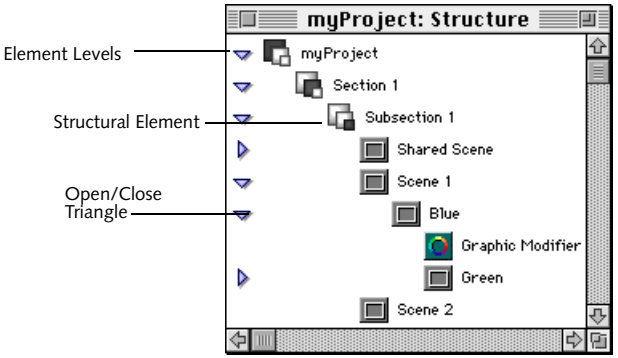


Figure 8.1 The Structure window

Structural Elements

Structural elements can contain and therefore provide structure for other elements.

A structural element that contains other elements or modifiers is called the "parent" of the first level of items it contains. For example, the project is the parent of its sections and each scene is the parent of its elements. Modifiers in the first level below an element are called "children" of that element. Children of an element are "siblings" of one another.

Behaviors are a special kind of modifier that can contain other modifiers. Modifiers within behaviors are the children of that behavior. See "Behavior Modifier" on page 12.123.

Open and Close Triangles

Along the left of the structure window are open and close triangles for collapsing or expanding those structural elements in the project that contain other components.

Click on a triangle to toggle its element or behavior between open (pointing down) and closed (pointing to the right). Option-Click a triangle to open or close all levels of items within the element or behavior.

When new scenes, elements or behaviors are added to the structure window, they do not have a triangle associated with them. This is because other components have not yet been placed in them.

Open/close triangles are shown as either shaded or filled with white. Shaded triangles indicate that media associated with that component has been loaded into memory. White-filled triangles indicate that the component contains media that has not yet been loaded by mTropolis.

The hierarchy of elements in a project affects the way that messages are passed between its components. See "Message Paths" on page 13.251.

Renaming Elements and Modifiers

When project components are first created, they are given a default name. This name is shown next to the item's icon in the structure view. Although mTropolis stores unique, internal identification numbers for each item in a project, making it possible to give items identical names, it is good practice to give items unique names. Items can be renamed in the structure window.

To rename an item:

- Click twice on its name, but do not double-click (i.e., click once, wait briefly, then click again) or click the name and press the Return key. The text highlights.
- Type the new name.
- Alternatively, double-click an element or modifier. Its dialog will appear on the screen. Enter the new name in the **Name** field of the dialog and click **OK**. The name of a component can also be changed by entering a new name for the selected element in the object info palette (see "Object Info Palette" on page 11.115).
- *Note: Projects cannot be renamed in the structure window. The name of a project is the*

same as its filename. Use the Save As menu item in the File menu to rename a project.

MANAGING THE STRUCTURE WINDOW

An elaborate project can have many sections and subsections with many scenes. mTropolis provides keyboard commands for limiting the display of the structure window to selected levels in the hierarchy.

Viewing Different Levels of the Structure Hierarchy

The commands described below move a selected item to the top of the structure window. This item becomes the view's new "root." All items above this object disappear from view, making the items below it easier to examine.

Click on the desired item to select it before using the commands described below:

- **⌘-Option-Down Arrow**: This keyboard command confines the structure window to display a selected item. The element is placed at the top of the structure window, showing its modifiers below it.
- **⌘-Option-Up Arrow**: This keyboard command displays the next level *above* the current level. The parent of the selected element appears at the top of the structure window.
- **⌘-Shift-Option-Up Arrow**: This keyboard command displays *all* levels above the currently-selected level, all the way up to the project level.

Controlling Open/Close Triangles

Use the following keyboard commands as alternatives to clicking on the expand and collapse triangle buttons:

- **⌘-Right Arrow**: This keyboard command expands the selected component.
- **⌘-Left Arrow**: This keyboard command collapses the selected component.
- **⌘-Option-Left Arrow**: This keyboard command collapses the entire hierarchy under the selected component.
- **⌘-Option-Right Arrow**: This keyboard command expands the entire hierarchy under the selected component.
- *Note: To hide or show modifiers in the structure window, use the Modifiers menu toggle in the View menu.*

Stepping through the Structure Window

Use the following keyboard commands to step from component to component up and down the list in the structure view.

- **Tab** or **Down Arrow**: Use these keys to move down through the list.
- **Shift-Tab** or **Up Arrow:** Use these keys to move up through the list.
- **Shift-Select**: This keyboard command allows new objects to be added to a selection set.

ADDING COMPONENTS TO A PROJECT IN THE STRUCTURE WINDOW

When a new project is created, it has a single section, a subsection, a shared scene and a first scene with the name "Untitled Scene".

New elements can be added to a project in the structure window using the **New Section**, **New Subsection**, **New Scene**, **New Graphic**, **New Sound** and **New Text** options in the Object menu.

Creating New Sections, Subsections, Scenes and Elements

To insert a new section, subsection, scene, or element into a project, select an item and choose the desired option from the Object menu.

Where the new item appears in the project's hierarchy depends upon both the item selected in the window and the option chosen from the menu:

- If the selected component is the same type as the item to be created, the new item appears as the last child in the selected item's parent component.
- If the selected component is a different type from the item created, the new item appears as a child of the nearest component that can be a parent.

For example, if a section is selected when **New Graphic** is chosen from the Object menu, the graphic appears as a child in the first scene below the section.

To create a new section:

- Click on an item in the structure view.
- Choose **New Section** from the Object menu (or use ⌘-Option-E). A new, untitled section is added to the project.

To create a new subsection:

- Click on an item in the structure view.
- Choose **New Subsection** from the Object menu (or use ⌘-Option-F). A new, untitled subsection is added to the project.
- *Note: When a subsection is created, a shared scene is automatically created with it.*

To create a new scene:

- Click on an item in the structure view.
- Choose **New Scene** from the Object menu (or use ⌘-Option-S). A new, untitled scene is added to the project.

To create a new graphic element:

- Select an item in the structure view.
- Select **New Graphic** in the Object menu (or use ⌘-Option-G). A new graphic element named "Untitled Graphic" is added to the project.
- *Note: New graphic elements created in the structure window appear in the top left corner of their scene when viewed in the layout window. If more than one new graphic element is added to a scene in the structure window, the elements will overlap in the layout window. Switch to the layout view to resize and position the new elements in the scene. Graphic elements created in the structure window are 50 x 50 pixels in the layout window.*

- *Note: Graphic elements cannot be added at the project, section or subsection levels.*

To link an external media file to a graphic element:

- Select a graphic element in the structure view.
- Choose **Link Media** from the File menu (or use ⌘-L). A standard file dialog appears.
- Navigate to the media file. Only valid media files are listed (i.e., QuickTime movies, mToons and PICTs).
- Double-click on the file name, or select the file name and select **Link**. The element's icon changes to the icon for the media type. The file name of the external media appears to the right of the icon.
- *Note: Any media in existing elements can be changed simply by linking new media to the element. Optionally, drag and drop new media onto the element from the asset palette (see "Asset Palette" on page 11.112).*
- *Note: By default, media that is added to the project appears in the layout window at the screen size of the external media file. This behavior can be changed by unchecking the* **Auto Resize Linked Media** *checkbox in the Application Preferences dialog (see "Auto Resize Linked Media Checkbox" on page 3.49).*

To create a new sound element:

- Select an item in the structure view.
- Choose **New Sound** from the Object menu (or press ⌘-Option-A). A new sound element is added to the project.

To link an external sound file to a sound element:

- Select a sound element in the structure view.
- Choose **Link Media** from the File menu (or use ⌘-L). A standard file dialog appears.
- Navigate to the sound file. Only valid sound files are listed (i.e., snd and AIFF).
- Double-click on the filename, or select the filename and select **Link**. The filename of the external sound file appears in the text field to the right of the icon.
- *Note: Sounds cannot be added at the project, section or subsection level. Sound elements cannot be added to a project from the layout or layers windows—they can only be added in the structure view. Sound effect modifiers, however, can be added to any level of the project hierarchy. See "Sound Effect Modifier" on page 12.208.*

To create a new text element:

- Select an item in the structure view.
- Choose **New Text** from the Object menu (or use ⌘-Option-D). A new text element is added to the project.
- *Note: New text elements created in the structure window appear in the top left corner of their scene when viewed in the layout window. If more than one new text element is added to a scene in the structure window, the elements will overlap in the layout window. Use the object info palette to precisely position the new text element, or switch to the layout view to resize and position the new elements in the scene. Text elements created in the structure*

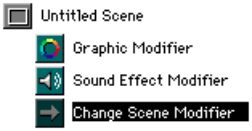
window are 50 x 50 pixels in the layout window.

CHANGING THE ORDER OF COMPONENTS IN THE STRUCTURE WINDOW

Messages are passed to components in the project hierarchy according to their descending order in the structure window. The messaging order of components can be changed by moving them into new positions.

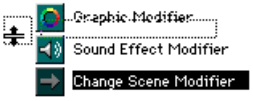
The following example illustrates the method for moving a modifier from one position in a scene to another. The method is the same for any component in a project.

The following figure shows the original order of a scene's three modifiers:



To reverse the order of the Sound Effect Modifier and the Change Scene Modifier:

- Click and drag the Change Scene Modifier until the element highlights. The cursor changes to an "insertion bar" when the change scene modifier is positioned between the other two modifiers. The highlight box (a dotted line rectangle) provides visual feedback for the insertion point of the objects as shown in the figure below:



- Release the mouse button. The modifier moves to its new position.
- *Note: Use Shift-Click to select multiple items to be moved.*

When using this method to change the order of elements, be careful that another element is not highlighted when the first element is dropped. Dropping an element on top of another element creates a parent/child relationship, affect the order in which messages are passed to elements in an unintended way. Parent/child relationships are discussed in more detail in "Message Passing among Elements" on page 8.86.

MESSAGE PASSING AMONG ELEMENTS

When elements are first created, they are positioned below the scene in the project's structural hierarchy. These elements are referred to as children of that scene. This hierarchical arrangement, combined with the messaging order of elements and modifiers in a scene, determines the path of messages that are passed through the scene.

For example, a message sent to a scene from a messenger is first passed to any modifiers on that scene according to their messaging order (i.e., the descending order in which they appear

in the structure window). From there, the message is passed to the first element in the scene and its modifiers, and then to the next element, and so on. When there are no further modifiers or elements in the scene, the path of the message comes to an end.

Effects of Parent/Child Relationships

The hierarchical relationship between elements in a scene can be changed, changing the path of messages that are passed. When an element is made a child of another element in a scene, messages are passed from the element to its child element(s) before being passed to the next element in the scene.

New parent/child relationships between elements can be created in the structure window using the drag and drop methods outlined in "Creating New Parent/Child Relationships in the Structure Window" on page 8.87. Alternatively, the relationship between elements in a scene can be changed using the parent/child tool in the layout window. See "Parent/Child Tool" on page 11.106.

The parent/child relationship among elements has an additional effect; as the layout position of an element is static relative to the position of its parent, a child element will move when its parent is moved.

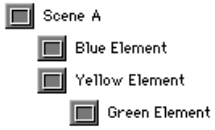
More information on the path of messages through a project can be found in "Message Paths" on page 13.251.

Creating New Parent /Child Relationships in the Structure Window

The following section illustrates the drag and drop method used to create new parent/child relationships among elements in the structure window.

To make one element the child of another, drag and drop the first element onto the second element. The second element will highlight as the first element is dragged over it. In the following figure, the Green Element is being dropped onto the Yellow Element.

The Green Element becomes a child of the Yellow Element. The result of this move, as seen in the structure window, appears in the figure below:



Note that the Green Element in the previous diagram is indented relative to the Yellow Element, indicating their new parent/child relationship. Parent/child relationships can also be made in the layout window using the Parent/Child Tool (see "Parent/Child Tool" on page 11.106).

- *Note: Multiple elements can be made children of another element. Use Shift-Click to select multiple elements to be moved.*

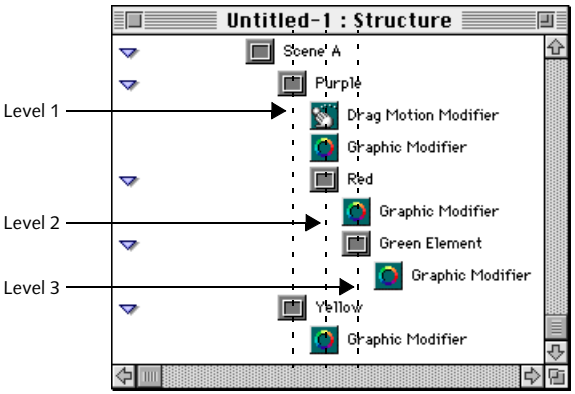


Figure 8.2 Relationships between components in the structure hierarchy.

- *Note: Graphic elements cannot be made children of sound elements.*

Appearance of Parent/Child Relationships in the Structure Window

The structure window shown in Figure 8.2 shows a series of child elements and their modifiers. Relationships between the various levels shown in the figure are described below.

Level 1

By default, any element that is placed in a scene appears on the first level of elements in the scene. The element's modifiers appear below it, indented to the right. In this example, the elements Purple and Yellow are children of Scene A.

Level 2

The element Red has been made a child of element Purple. Therefore, Red appears on the next element level in the scene, which is indented relative to the Purple element. The Red element's Graphic Modifier appears below it, indented to the right.

Level 3

The Green element is a child of the Red element. It appears on the next element level, indented relative to the Red element, along with Red's Graphic Modifier. Green's Graphics Modifier appears below it, indented yet another step to the right.

Chapter 9. Layout Window

This chapter provides information on working with the layout window, one of mTropolis' three editing views. The other views are described in Chapter 8, "Structure Window", and Chapter 10, "Layers Window".

To make the layout window active:

- Choose the **Layout Window** option from the View menu (or use ⌘-1). The layout window (Figure 9.1) appears in the foreground.

All three editing windows can be open at once. Any of the open windows can be made active by clicking on them. Optionally, use the window's corresponding keyboard command to display it or make it active: Layout Window: ⌘-1, Structure Window: ⌘-2, Layers Window: ⌘-3.

LAYOUT WINDOW OVERVIEW

The layout window is the default view when mTropolis creates a new project (Figure 9.1).

When mTropolis is first run, or when a new project is created, mTropolis creates an untitled project with a single section (with the default name "Untitled Section"), a single subsection ("Untitled Subsection"), a shared scene ("Untitled Shared Scene") and a scene ("Untitled Scene").

The Scene

The main workspace found in the center of the layout window represents the current scene being edited. The current scene is the scene whose name appears in the Scene pop-up.

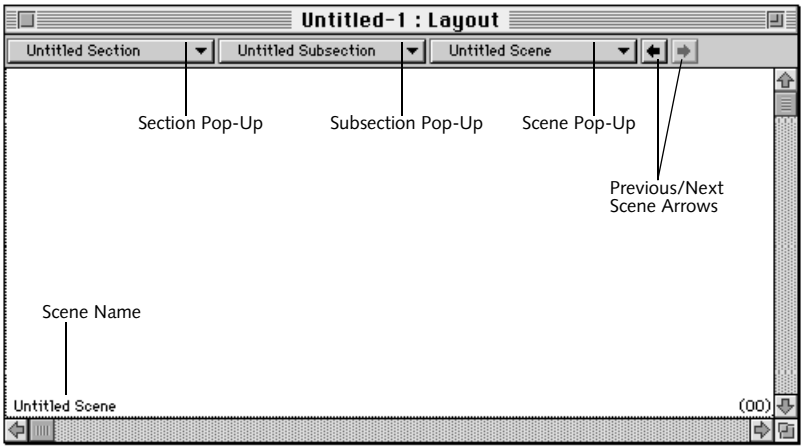


Figure 9.1 A new, empty layout window

Default Properties of Scenes

A scene has the standard properties of a graphic element—it is colorless and transparent by default, in the layout window its boundaries are represented by a frame, and, like other elements, it can be configured with modifiers and linked to external media. Its default settings can also be edited in its Element Info dialog.

The boundaries of the scene appear in the layout window as a frame. The scene's default size, 640 x 480 pixels, can be changed using the Object Info palette. This palette can be displayed by selecting **Object Info Palette** from the View menu.

Initially, scenes are locked into position in the layout window. When locked, scenes cannot be moved. However, media can still be linked to the scene by using the **Link Media-File** option in the File menu. To unlock a scene, select the scene and select the **Lock** menu toggle in the Object menu (or use ⌘-K).

Layer Order Numbering of Elements

The first scene in a new project has a layer order of 00. As each element is added to the scene, it is given a unique sequential layer order number that is incremented by 1. The layer order number appears at the bottom right of the element. Elements with higher layer order numbers appear to be "in front" of elements with lower layer order numbers.

The layer order of elements in a scene can be changed using the following methods:

- Use the layer order options from the Arrange menu. See "Changing the Layer Order of Elements" on page 5.57.
- Drag and drop elements in the layers window. See "The Layer Order Grid" on page 10.96.
- Change the layer order number in the Element Info dialog. See "The Element Info Dialog" on page 6.62.
- Use the Object Info palette of a selected element. See "Object Info Palette" on page 11.115.

ADDING ELEMENTS TO SCENES

Graphic and text elements can be added to scenes using the layout tools in the tool palette or by using options in the Object menu. Graphic media can also be added to a scene by dragging and dropping assets from the Asset palette. By default, all elements added to a scene become children of the scene and appear below the scene in the project's structural hierarchy.

As a result, deleting a scene deletes both the scene and any elements and modifiers it contains from the project.

To create a graphic element in the layout window:

- Select the graphic tool from the tool palette. This tool looks like a single rectangle. The cursor changes to a cross hair.
- Click and drag on the scene to create a new graphic element. As you drag, a graphic element frame is created. The name

"Untitled Graphic" appears in the bottom left of the element's frame and its layer order number appears in parentheses at the bottom right.

To create a text element in the layout window:

- Select the text tool from the tool palette. This tool looks like a letter "A". The cursor changes to an "I" beam and a small box.
- Click and drag on the scene to create a new text element. As you drag, a new text element frame is created.
- Click inside the text element. A flashing insertion bar appears.
- Enter the desired text from the keyboard. When finished, choose the selection tool and click outside the text element to commit the text.
- The text is displayed in black on a white background. The name "Untitled Text" appears at the bottom left of the element's frame and its layer order number appears in parentheses at the bottom right.

Modifiers can be added to both graphic and text elements. Graphic elements can be linked to external media (see "Linking Media to an Element in the Layout Window" on page 9.91). Text in text elements can be modified using options from the Format menu (see Chapter 4, "Format Menu").

More information on the graphic and text tools can be found in "Tool Palette" on page 11.103. Elements can also be added to scenes in the structure and layer windows. See "Adding Components to a Project in the Structure Window" on page 8.84 and "Creating Scenes and Elements in the Layers Window" on page 10.97.

Linking Media to an Element in the Layout Window

- Select an existing element and choose **Link Media-File** from the File menu (or use ⌘-L). A standard file dialog appears. Valid media types will be listed.
- Select the desired media file and click **Link**. The media appears within the element's frame. A thumbnail of the media file is automatically placed in the asset palette.

By default, the element will conform to the spatial dimensions of the external media file. Resize the element by dragging on its frame or use the Object Info palette to precisely resize the element. See "Object Info Palette" on page 11.115.

- *Note: There are generally five levels of structural elements in a project's hierarchy: project, section, subsection, scene and element. Of these elements, only scenes (which behave much like graphic elements) and elements can contain external media.*
- *Note: Sounds can only be linked to sound elements, which can only be created in the structure window. See Chapter 8, "Structure Window" for details.*

Other Techniques for Linking Media

Media can also be linked to elements in the structure window, layers window, and asset palette:

- For instructions on how to create and link media to elements in the structure view, see "Creating New Sections, Subsections, Scenes and Elements" on page 8.84.
- For instructions on linking media in the layers window, see "Linking Media to Elements in the Layers Window" on page 10.100.
- The asset palette can also be used to link media, see "Linking Media to the Asset Palette" on page 11.114.

NAVIGATING IN THE LAYOUT WINDOW

The layout window provides a view of a single scene. Use the Section, Subsection and Scene pop-ups at the top of the layout window (Figure 9.1) to move to new locations in a project.

To navigate to a new scene:

- Select the appropriate section from the Section pop-up (if there is more than one section in the project).
- Select the appropriate subsection from the Subsection pop-up (if there is more than one subsection in the project).
- Select the desired scene from the Scene pop-up. mTropolis changes to the selected scene.

Optionally, you can use the Next/Previous Scene arrows to move to other scenes within the currently-selected subsection.

Adding New Sections, Subsections and Scenes to a Project

The Section, Subsection and Scene pop-ups can be used to create new sections, subsections and scenes.

To create a new section or subsection:

- Choose **New Section** or **New Subsection** from the Section or Subsection pop-up. The new section or subsection appears in the layout window. The name of the new section or subsection is shown on the Section or Subsection pop-up.

When a new subsection is created, a shared scene is also automatically created. See "The Shared Scene" on page 9.93.

To create a new scene:

- Choose **New Scene** from the Scene pop-up. The new scene appears in the layout window. The scene is created with a default name ("Untitled Scene").
- Rename the new scene by double-clicking within its frame to display its Element Info dialog. Enter a new name into the element name text field. When the Element Info dialog is closed, the scene is renamed.
- *Note: Scenes are initially locked into position in the layout window. Locked scenes cannot be moved or resized. However, media can be linked to a locked scene by selecting the **Link Media-File** option in the File menu (and, by default, the scene will resize itself to fit the linked media). To unlock a scene, select the scene and toggle **Lock** off in the Object menu (or use ⌘-K).*

Alternatively, the scene can be renamed using the Object Info palette:

- Choose **Object Info Palette** from the View menu. The palette appears.
- Click on the scene.
- Highlight the scene name, found in the top left of the Object Info palette.
- Edit the scene name in the name field.
- Click anywhere outside the name field to commit the change.
- *Note: Sections, subsections, scenes, elements and modifiers can also be renamed in the structure window. See "To rename an item:" on page 8.82.*

THE SHARED SCENE

mTropolis automatically adds a "shared scene" to a new subsection when it is created. The contents of the shared scene are visible in every scene that belongs to the subsection when the project is viewed in runtime mode. Shared scenes are useful for storing background images and the elements and modifiers that are common to all the *scenes* in a subsection.

The shared scene precedes all other scenes in the section.

- *Note: By default, shared scenes are locked when they are first created. To unlock a shared scene, select it and choose* ***Lock*** *from the Object menu (or use ⌘-K).*

To show the shared scene in edit mode:
By default, the shared scene does not show itself when editing other scenes. It is usually only visible in runtime mode.

- Choose **Reveal Shared Scene** from the View menu to toggle the display of the shared scene on and off while editing other scenes. The shared scene is displayed behind other elements in the scene as it will appear in runtime.

Chapter 10. Layers Window

This chapter provides information on working with the layers window, one of mTropolis' three editing views. The other views are described in Chapter 8, "Structure Window", and Chapter 9, "Layout Window".

To open the layers window:

- Choose **Layers Window** from the View menu (or use ⌘-3). The layers window (Figure 10.1) appears.

All three editing windows can be open at once. Any of the open windows can be made active by clicking on them. Optionally, use the window's corresponding keyboard command to display it or make it active: Layout Window: ⌘-1, Structure Window: ⌘-2, Layers Window: ⌘-3.

LAYERS WINDOW OVERVIEW

The layers window can be used to view and edit a subsection of the project at a time. Figure 10.1 shows a subsection from a project. Controls in the layers window are described below.

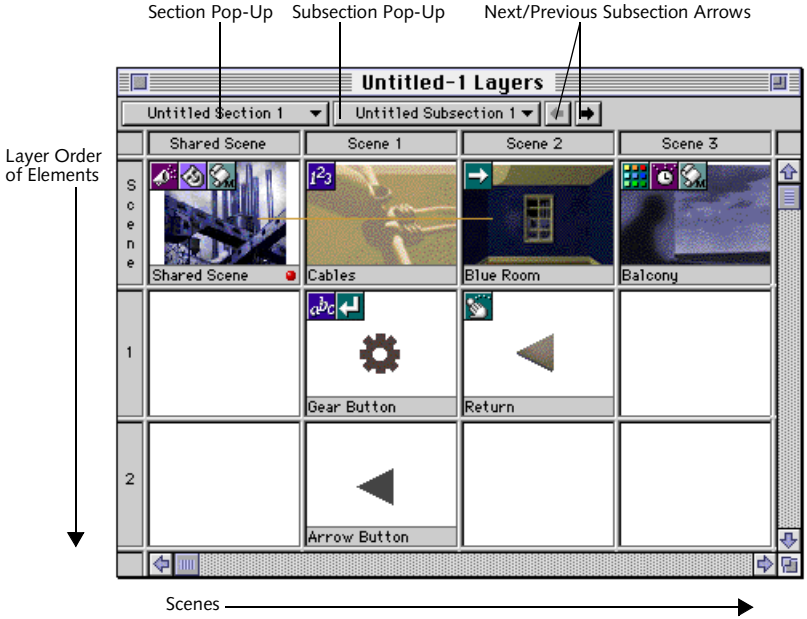


Figure 10.1 The Layers window. Items in the "grid" are child elements of the selected subsection organized horizontally by scene and vertically by the layer order of the elements.

The Layer Order Grid

The layers window displays all the component elements of a subsection. Thumbnail images in the "grid" represent individual elements. Each column of the grid represents a scene. The elements in an individual scene are shown in ascending layer order.

Layer Order

Each column of the grid shows elements of the corresponding scene in their layer order, that is, the order in which the elements are drawn on the screen. The scene at the top of the grid is drawn first, then the next element in the column, and so on.

Elements drawn on top of each other create the illusion that the two-dimensional (X,Y) screen has a depth (Z) dimension. The effect is commonly called "2.5D" (Figure 10.2).

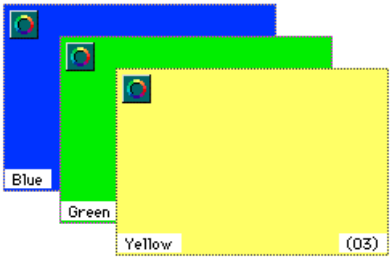


Figure 10.2 The effect of graphic layers

The layer order numbering begins with the scene at 00, and is incremented by 1 as new elements are added to the scene.

The order of elements in a scene can be changed in the layers window by simply dragging and dropping an element's thumbnail image to a new position in its current column.

Scene Order

As mentioned previously, each column in the grid represents a scene. The column furthest to the left represents the shared scene. Subsequent scenes are shown in ascending order to the right.

The order of scenes can be important—for example, when the scene change modifier is being used with its "Next Scene in Subsection" or "Previous Scene in Subsection" options. The order of scenes can be changed in the layers window by simply dragging and dropping a scene's thumbnail image to a new position in the Scene row.

When new scenes are created and added to the subsection, they are added as untitled scenes. When a scene is deleted, all other scenes automatically move to fill the space left by the deleted scene. Note that, because the elements of a scene are children of that scene, deleting a scene also deletes all of its elements.

Shared Scenes

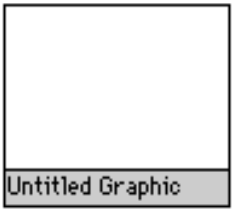
The leftmost scene shown in the grid is the shared scene. Shared scenes are special scenes that come first in a subsection. They are used to store the elements and modifiers common to all the scenes in a subsection. For example, elements and modifiers that form navigational buttons are often placed in the shared scene.

- *Note: Any scene that moves into the leftmost position in the grid (i.e., any scene that is made the very first scene in a subsection) becomes the shared scene of its subsection. Any scene that*

was previously in that position becomes a regular scene and is no longer shared.

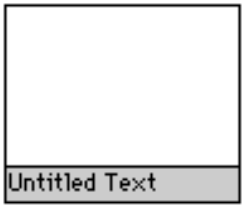
Elements and Modifiers

Graphic elements are displayed as thumbnails in the "cells" that make up the grid. Newly created graphic elements are shown with the default name "Untitled Graphic" as shown below:



Graphic elements linked to external media (i.e., mToons, QuickTime movies, PICTs) are shown as small "thumbnail" images. The name of the element appears across the bottom. Any modifiers on the element will appear across the top of the thumbnail as shown below.

Text elements are displayed as white icons with the name of the text element at the bottom and any modifiers across the top of the thumbnail. A newly-created text element with the name "Untitled Text" looks like this in the layers window:



Hiding Editing Aids Using View Menu Options

The following options can be used to reduce visual clutter in the layers window:

- Toggle **Frames** off in the View menu (or use ⌘-Shift-F) to hide element frames, modifiers and names.
- Toggle **Modifiers** off in the View menu (or use ⌘-Shift-M) to hide element modifiers.
- Toggle **Names** off in the View menu (or use ⌘-Shift-N) to hide element names.

CREATING SCENES AND ELEMENTS IN THE LAYERS WINDOW

New scenes, graphic and text elements can be quickly created in the layers window by using the options in the Object menu.

To create a new scene:

- Select the first unoccupied cell in the Scene row (i.e., the first row) of the layout window.
- Choose **New - Scene** from the Object menu (or use ⌘-Option-S). A new scene is added after the last scene in the subsection.

A new scene can also be inserted between existing scenes:

- Select an existing scene and choose **New Scene** from the Object menu (or use ⌘-Option-S). The new scene appears in the targeted location. The scene that was in that location moves to the right (i.e., it becomes the "next" scene of the newly-created scene). All later scenes also move one position to the right.

To create a new graphic element:

- Select any grid cell, occupied or unoccupied, under an existing scene in the layers window.
- Select **New Graphic** from the Object menu (or use ⌘-Option-G). The new graphic element appears in the targeted location. If an occupied cell was selected, the selected element, and any elements below it, are moved down one position in the layer order to accommodate the new graphic element. The newly-created graphic element has the name "Untitled Graphic".

To create a new text element:

- Select any grid cell, occupied or unoccupied, under an existing scene in the layers window.
- Select **New Text** from the Object menu (or use ⌘-Option-D). A new text element appears in the targeted location. If an occupied cell was selected, the selected element, and any elements below it, are moved down one position in the layer order. A new text element is called "Untitled Text".

EDITING IN THE LAYERS WINDOW

During project editing, it is often necessary to duplicate scenes, elements, or modifiers, or to move them from one place to another in a subsection. Because the layers window shows small images of all the media elements in a subsection, it is a convenient window in which to duplicate and relocate components.

Standard project editing tools can be used in the layers window. The **Cut, Copy, Paste** and **Duplicate** options in the Edit menu can be used to edit elements and modifiers.

As in other windows, modifiers and elements can be moved in the layers window using drag and drop techniques. These components can also be configured using the standard methods.

Tools that are *not* active in this window include the graphic, crop, text and parent/child tools of the Tool palette.

Changing the Order of Scenes

The order of scenes in a subsection can be easily changed using the layers window. Moving a scene also moves all of the elements within the scene (i.e., an entire column in the layers window is moved).

To change the order of a scene in a subsection:

- Select the scene to be moved.
- Drag and drop the scene over the scene to be displaced. The dropped scene appears in the new location. The scene that previously occupied the targeted location moves one space to the right (i.e., it becomes the "next"

scene of the relocated scene). All other scenes in the subsection move to accommodate the change.

- *Note: Use Shift-Click to select a group of scenes to be moved. Also, Option-Drag can be used to move a copy of a scene, leaving the original in place.*

Changing the Layer Order of Elements

The layer order of elements in a scene can be changed by dragging and dropping an element over another element.

To move an element between other elements:

- Select an element in the layers window.
- Drag and drop the element over the element to be displaced. The dropped element appears in the new location. The element that previously occupied the targeted location moves down one position in the layer order. All later elements in the layer order also move down.
- *Note: Use Shift-Click to select a group of elements to be moved. Also, Option-Drag can be used to move a copy of an element, leaving the original in place.*

To move an element to an empty grid location:

- Click on the element and drag and drop it onto the empty grid location. The element appears in the new grid cell.

Duplicating Scenes or Elements

Elements or scenes can be duplicated using the same technique in the layers window.

To duplicate a scene or element:

- Choose **Duplicate** from the Edit menu (or ⌘-D) to duplicate the currently-selected scene, graphic or text element. A duplicated scene will appear to the right of the original scene. A duplicated graphic or text element will appear below its original in the layer order.

Other Methods for Editing the Layer Order of Elements

The Arrange Menu Options

The options for changing the layer order of elements in the Arrange menu (**Bring to Front, Send to Back, Bring Forward, Send Backward**) can be used in all editing windows, including the layers window. See "Changing the Layer Order of Elements" on page 5.57.

The Element Info Dialog

An element's layer order number can be changed in its Element Info dialog. This method can be used in all the editing windows. Double-click on the element or choose **Element Info** from the Object menu (or use ⌘-I) to open the selected element's Info dialog. See "The Element Info Dialog" on page 6.62.

Object Info Palette

The object info palette can be used to view and change the size, position and layer order number of a selected element. It can also be used to change an element's name. To open this palette, select **Object Info Palette** from the View menu (or use ⌘-7). See "Object Info Palette" on page 11.115.

Eliminating Gaps in the Layer Order

If an element is moved from one scene to another, a gap is created in the layer order of elements in the original scene. Figure 10.3 shows what happens when an element is moved into another scene.

Figure 10.3 shows the gap that has been created in Scene 1 by moving the Balcony element from its original position (upper left illustration) into Scene 2 (upper right illustration). This gap can be eliminated by selecting Scene 1 and choosing **Eliminate Gaps** from the Arrange menu. The elements in Scene 1 are moved to eliminate empty layers between elements (lower illustration).

LINKING MEDIA TO ELEMENTS IN THE LAYERS WINDOW

The File menu's **Link Media** option can be used to link external media files to graphic elements in the layers window.

To link a an external media file:

- Select an element.
- Choose **Link Media-File** from the File menu (or use ⌘-L). A standard file dialog appears.

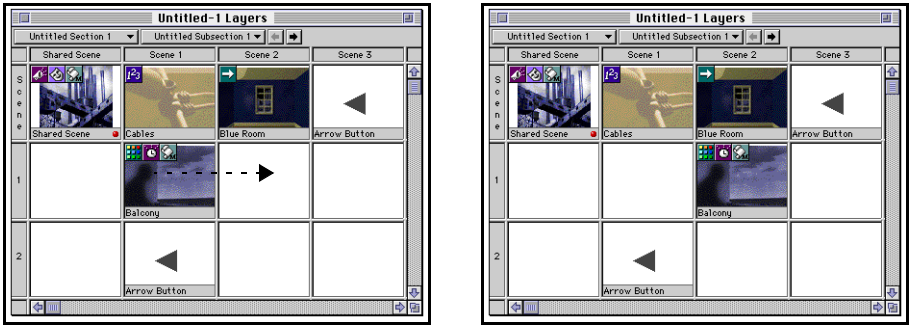
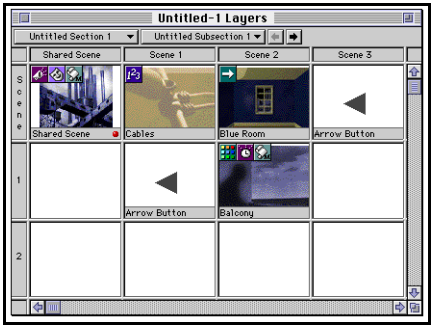


Figure 10.3 Eliminating gaps in the layer order: Before moving Balcony element (upper left); After moving Balcony element (upper right); After applying Eliminate Gaps from the Arrange menu (below).



- Navigate to the external media file. Valid file types appear in the file list (QuickTime movies, mToons and PICTs).
- Double-click on the desired filename or click on the filename and choose **Link**. A new thumbnail representing the media appears in the grid cell. The filename of the linked file replaces the word "Untitled Graphic."
- The element can be renamed by double-clicking it to display its Element Info dialog, where a new name can be entered, or by using the Object Info palette.

Adding Graphic Elements to the Layers Window from the Asset Palette

All media that has been linked to a project is stored in the asset palette. These assets can be dragged and dropped into a project in any view.

Unlike elements that are first created and then linked to media, assets in the palette do not have elements to contain them. However, when an asset is dragged and dropped from the asset palette into the project, a new element is automatically created to contain the media.

To add a media element from the asset palette:

- Open the asset palette by selecting **Asset Palette** from the View menu (or use ⌘-6). The asset palette appears.
- Drag the desired media element from the asset palette to an empty grid location. An image representing the media appears in the grid cell.

NAVIGATING IN THE LAYERS WINDOW

Use the Section and Subsection pop-ups at the top of the layers window (Figure 10.1 on page 10.95) to display different subsections of a project.

To navigate to a new section:

- Select the section in which to work from the Section pop-up.
- Select the subsection in which to work from the Subsection pop-up. The layers view displays the scenes of the newly-selected subsection.
- The Next/Previous Subsection arrows can be used to move to other subsections in the section.

Adding New Sections or Subsections to a Project

The Section and Subsection navigation pop-ups can also be used to create new sections and subsections.

To create a new section or subsection:

- Choose **New Section** or **New Subsection** from the Section or Subsection pop-up. The new section or subsection is created with the default name "Untitled Section" or "Untitled Subsection". This section or subsection becomes the current one and its name appears as the label of the pop-up.

The name of a new Section or Subsection can be changed using the Structure window or the Object Info palette, as described below.

To rename a section or subsection in the structure window:

- Switch to the structure window by selecting **Structure Window** from the View menu (or use ⌘-2).
- Click on the name of the section or subsection to be renamed, pause briefly and click again (or click on the name and press Enter). The object's name highlights.
- Type in the new name.

To rename a section or subsection using the object info palette:

- Switch to the structure window by selecting **Structure Window** from the View menu (or use ⌘-2).
- Display the Object Info palette by choosing **Object Info Palette** from the View menu (or use ⌘-7).
- Select the section or subsection to be renamed in the structure window.
- The name field at the top left of the Object Info palette highlights.
- Type the new name in the palette's name field (the upper left text box).
- Click anywhere outside the name field to commit the change.

Chapter 11. Palette Reference

This chapter provides information on the palettes used to hold mTropolis tools, modifiers, aliases, and media assets, the basic building blocks of the mTropolis authoring environment. These palettes can be shown or hidden by toggling their menu options in the View menu.

When visible, the palettes float over the three editing views (i.e., the layout, structure and layers windows).

- The Tool palette contains tools for creating graphic and text elements in the layout window. Tools on this palette can also be used to size elements and link them in new hierarchical relationships.
- The Modifier palettes contain the modifiers that are supplied with mTropolis.
- The Alias palette stores the originals of modifiers that have been aliased in a project.
- The Asset palette stores icons and thumbnails of media linked to the project.
- The Object Info palette is used to view and change the name, size, position and layer number of elements. It can also be used to identify the current cel of an mToon and to step through its cels while in edit mode.

TOOL PALETTE

The Tool palette (Figure 11.1) contains tools for creating graphic and text elements, sizing them and linking them in new hierarchical relationships. Only one tool can be selected at a time.

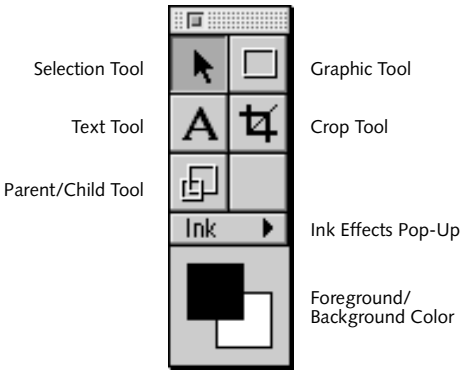


Figure 11.1 The Tool palette

Selection Tool

The selection tool is a pointing device. It can be used to:

- Select items by single clicking.
- Select multiple items by Shift-clicking or by dragging on the screen to enclose items in a marquee.

- Move items by clicking and dragging. If the Shift key is held down while dragging an element, the element is constrained to move in only the horizontal or vertical direction.
- Resize an element by clicking and dragging its frame to the new desired size. If the Option key is held down while resizing, the element resizes around its center point. If the Shift key is held down while resizing, the element maintains its aspect ratio. If the Control key is held down while resizing, the element resizes to exact multiples of its current size. Note that resizing also works with multiple selections.
- Open an element or modifier configuration dialog by double-clicking on the item.

Graphic Tool

The graphic tool can be used to create new graphic elements in the layout window. New graphic elements can then be linked to media files (see "Link Media—Attaching External Media Files to Elements" on page 2.34).

- *Note: This tool cannot be used in the structure or layers window. To create graphic elements in these views, select* **New-Graphic** *from the Object menu.*

To create a graphic element in the layout window:

- Click on the graphic tool. The cursor changes to a cross hair.
- Click and drag on the scene displayed in the layout window to create a new graphic element frame. The default name of the item, "Untitled Graphic," appears in the bottom left of the frame, and its layer order number appears in parentheses at the bottom right.

Graphic element properties can be changed by applying ink effects (see "Ink Effects" on page 11.107 and "Foreground and Background Colors" on page 11.109) or graphic modifiers (see "Graphic Modifier" on page 12.152).

Text Tool

The text tool can be used to create new text elements in the layout window.

- *Note: This tool can only be used in the Layout window. It cannot be used in the Structure or Layers window. To create text elements in these views, select* **New Text** *from the Object menu.*

To create a text element in the layout window:

- Click on the text tool. The cursor changes to an "I" beam and a small box.
- Click and drag on the scene displayed in the layout window to create a new text element frame of the desired size. Note that if the text tool is not dragged, it creates a small text element by default.
- A flashing insertion bar appears inside the new text element. Enter the desired text from the keyboard (text can also be entered by pasting). The text is displayed in black on a white background.

- Drag on the scene to create another text area, or click on the selection tool (or another tool in the tool palette) to end text entry. The default name of the element, "Untitled Text," appears in the bottom left of the frame and its layer order number appears in parentheses at the bottom right.

Characters Supported by mTropolis

mTropolis supports the ANSI character set. All roman-based characters are supported on all mTropolis platforms. For example, German, Italian, and French text is converted and displayed properly in both Macintosh and Windows titles. mTropolis does not support multi-byte character sets (e.g., kanji).

- *Note: Many commonly-used Macintosh symbols are not in the ANSI standard character set and cannot be displayed properly on Windows. For example, the bullet character (typed by pressing Option-8) found in most Macintosh fonts is not in the ANSI character set. When displayed on Windows, these characters are replaced with the "pipe" character (|). These characters will display on Windows if the text element is converted to a bitmap (see "Convert Text to Bitmap Checkbox" on page 6.65).*

- *Note: The "tab" character and tab stops are not fully supported by mTropolis. When typed into a text element, tab characters are converted to spaces. However, if text is pasted from the clipboard into a text element, tabs are preserved. These tab characters may cause unexpected word wrapping when the title is built for Windows platforms. When pasting text from another application into mTropolis, either remove any tabs or replace them with spaces before copying the text.*

Changing the Appearance of Text

Text properties can be changed using the options found in the Format menu (see Chapter 4, "Format Menu") or by applying text style modifiers (see "Text Style Modifier" on page 12.215), ink effects (see "Ink Effects" on page 11.107 and "Foreground and Background Colors" on page 11.109), or graphic modifiers (see "Graphic Modifier" on page 12.152).

- *Note: When a project is built into a title for distribution, fonts are not bundled into the build file. To display properly, any fonts used by the project must be installed on the target system. Note also that, for fonts to work on both Macintosh and Windows systems, the same font must be made available on both platforms. Those fonts must have exactly the same names on both platforms. Fonts that will be used for Macintosh and Windows distribution should be licensed from the same vendor.*

Crop Tool

The crop tool can be used to reduce the size of the visible area of media in graphic elements or the visible area of text in text elements. The media itself is not resized; rather, a new view of the media is created.

To crop an element:

- Select the crop tool. The cursor changes to a crop tool icon.

- Click and drag across the element that you wish to crop. The visible area of the media is cropped to the newly-specified cropping region.
- If the Shift key is held down while dragging the crop tool, the media is cropped to the intersection of the old and new cropping regions.
- If the Option key is held down while the crop tool is dragged, the cropping area can be extended to reveal parts of the media that were previously cropped.

To immediately undo a cropped element:

- Choose Undo from the Edit menu (or use ⌘-Z). The element returns to its pre-cropped size.
- *Note: Alternatively, select the Revert Size option in the Object menu (⌘-R) to return the element to its original size.*

Parent/Child Tool

The parent/child tool can be used to alter the hierarchical relationship between elements in a scene.

When elements are created in the layout window, they are automatically positioned below their scene in the project's structural hierarchy (i.e., they are children of the scene). When the hierarchical relationship between a scene and its elements is changed, the path of messages that are passed through the scene is altered. For example, when an element is made a child of another element in a scene, messages will be passed from the parent element to its child element(s) before being passed to the next element in the scene. More information about parent/child relationships and message passing can be found in "Message Passing among Elements" on page 8.86.

The parent/child relationship among elements has an additional effect; because the layout position of an element is static relative to the position of its parent, a child element will move when its parent is moved.

The sections below describe techniques for using the parent/child tool. When working with this tool, keep in mind that, by default, the scene is the parent of the elements it contains. When using the parent/child tool, make sure the scene is deselected.

To make one element the child of another:

- Click on the parent/child tool.
- Click and hold on the element targeted as the child.
- Drag the mouse. A line appears from the center of the element to the location of the cursor.
- Drag the line onto the element targeted as the parent and release the mouse button. The elements are linked. Now when the parent is moved, the child moves with it.
- *Note: Graphic elements cannot be made children of sound elements.*

To break the parent/child relationship between two elements:

- Click on the parent/child tool.

- Click and drag on the child element.
- A line appears. Release the mouse to drop the line on the scene. The scene becomes the child's new parent, breaking the relationship with the other element.

To make several elements children of one element:

- If it is currently selected, de-select the scene.
- Use Shift-Click to select multiple elements to be made children. Alternatively, drag a marquee around the elements.
- Click on the parent/child tool.
- Click and drag from one of the selected elements. Lines from all the elements attach to the cursor.
- Drop the lines onto the element targeted as the parent. The targeted element becomes the parent of the multiply-selected elements.

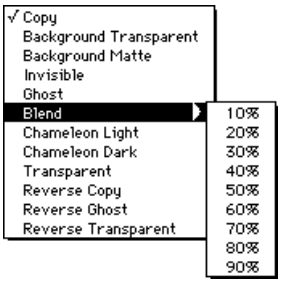
To break the parent/child relationship between a parent and its children:

- Select one or more of the child elements.
- Click on the parent/child tool.
- Click and drag from any selected child element to the scene. Lines from all the elements attach to the cursor.
- Drag and drop the lines on the scene. All the elements become children of the scene. The previous parent/child relationship among the elements is broken.

Using the Structure Window to Modify Parent/Child Relationships

Parent/child relationships can also be created in the structure window. See "Creating New Parent/Child Relationships in the Structure Window" on page 8.87.

Ink Effects



Ink effects can be applied by selecting an element and choosing an option from the Ink pop-up. These options are the same as the ones available in the "Ink:" menu of the graphic modifier dialog (see "Graphic Modifier" on page 12.152). The Ink pop-up dialog options are described below.

- *Note: In titles built for Windows platforms, only the Copy, Background Transparent, Background Matte, and Invisible inks take effect. Other inks have no effect when used in titles built for Windows.*

Copy

This is the default ink effect. It displays the graphic element in its original state.

Background Transparent

Background Transparent makes the element's background color transparent. All pixels of the specified color in the element are made

transparent. That is, other elements drawn beneath the element will be visible through the transparent areas. The color is specified in the background color swatch (see "Foreground and Background Colors" on page 11.109).

Background Matte
Background Matte is similar to Background Transparent. In addition to adding transparency, however, this ink makes the transparent regions unresponsive to mTropolis events. Using this ink is a simple way to create objects that behave as if they have a complex border.

Invisible
An element is invisible when this option is applied. Note that this ink effect is not the same as making the element hidden (using the Hide command described on page 13.234). The element is not visible, but it has been enabled, has all of its normal attributes, and continues to respond to user mouse events.

Ghost
Applied to black and white elements, Ghost creates an image that can only be seen when placed over a black background. In color, Ghost draws with the current background color. Since white is mTropolis' default background color, Ghost can be used to make text appear white on a transparent background.

- *Note: This ink has no effect in titles built for Windows platforms.*

Blend
The blend ink effect makes the colors of overlapping elements blend together. The blend amount can be selected, in increments of 10% from 10% to 90%, from the cascading menu of blend percentages.

- *Note: This ink has no effect in titles built for Windows platforms.*

Chameleon Light
With this ink effect, the colors in a graphic on top of a white graphic turn opaque. When placed over a colored graphic, light colors are tinted.

- *Note: This ink has no effect in titles built for Windows platforms.*

Chameleon Dark
With this ink effect, the colors are lightened when the element is on top of another graphic. Placed over white, the graphic becomes transparent. Placed over a colored graphic, dark colors are tinted.

- *Note: This ink has no effect in titles built for Windows platforms.*

Transparent
Applied to black and white elements, this ink creates an image that can only be seen when placed over a black background. In color, Transparent draws with the current background color.

- *Note: This ink has no effect in titles built for Windows platforms.*

Reverse Copy
Reverses the black and white colors: all white pixels will appear black, all black pixels will appear white. Colors are inverted.

- *Note: This ink has no effect in titles built for Windows platforms.*

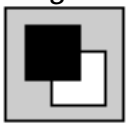
Reverse Ghost
Black pixels become transparent and white pixels remain white. When a graphic with this ink is placed over a graphic with white pixels, the white in the first graphic becomes transparent.

- *Note: This ink has no effect in titles built for Windows platforms.*

Reverse Transparent
White pixels change to black, and black pixels become transparent.

- *Note: This ink has no effect in titles built for Windows platforms.*

Foreground and Background Colors



The foreground and background color swatches are used to change the appearance of elements in the layout window.

By default, the foreground color of elements is black, and the background color is white. For text elements, the foreground color is the color used when entering text into text elements, and the background color is the color used to draw its field.

To change the foreground/background color of a graphic or text element:

- Select an element.
- Click and hold on either the foreground or background color box. The cursor changes to an eyedropper tool and a palette appears. If the scene has not been assigned a custom palette, the system palette appears. If the scene has been assigned a custom palette, this palette will appear.
- Drag the eyedropper to a color on the palette *or* to a color in an image on the screen. Release the mouse. The foreground or background color in the element changes to the selected color.
- *Note: For text elements, the foreground color is the color used for the letters themselves.*

MODIFIER PALETTES

The modifier palettes contain mTropolis' built-in modifiers. To display or hide each palette, choose **Modifier Palettes-Logic** (⌘-Option-1), **Modifier Palettes-Effects** (⌘-Option-2), or **Modifier Palettes-Extras** (⌘-Option-3) from the View menu.

Each palette contains a number of modifiers, represented by icons. To see the name of a modifier in the palette, move the cursor over a modifier's icon while holding down the Control key.

Complete descriptions of the modifier palettes and individual modifiers can be found in Chapter 12, "Modifier Reference".

Applying Modifiers to Project Components

Modifiers can be placed on any element or in any behavior in a mTropolis project. The method for placing a modifier is the same in all views:

- Drag a modifier from the modifier palette and drop it on its destination. In the layout and layers views, the modifier appears on the element on which it was dropped. In the structure view, the modifier appears below and to the right of the element on which it has been dropped.

To add a modifier to a behavior:

- Drag the modifier over a behavior icon that has already been placed in a project. When the behavior icon highlights, drop the modifier by releasing the mouse.
- Optionally, double-click on the behavior to open it. Drag and drop the modifier into the behavior window. The modifier is added to the behavior.

More information on behaviors can be found in "Behavior" on page 12.129.

Changing Modifier Defaults

Once a modifier has been placed on a project component, the modifier's effect can be specified by altering the default settings in its dialog.

To view or change the settings in a modifier's dialog:

- Double-click on the modifier. The modifier's dialog box appears.
- Change any settings within the modifier dialog. The new settings take effect when the dialog is closed. See Chapter 12, "Modifier Reference" and Chapter 13, "Modifier Pop-Up Menus and Message Reference" for more information on modifier settings.

ALIAS PALETTE

The alias palette stores the master copies of aliased modifiers. An alias is a productivity tool that is used to globally manage modifiers with identical settings. Select **Alias Palette** from the View menu (or use ⌘-5) to display the alias palette (Figure 11.2)

An alias is a special copy of a modifier that takes its functionality from the modifier from which it was made. This "master copy" is automatically placed in the alias palette when the alias is made (using the **Make Alias** option from the Object menu or press ⌘-M). Additional aliases that refer to this master copy can also be created and placed throughout a project.

The advantage of using aliases is that they can be globally updated from a single source. Changing the settings of an alias changes the settings of both the master copy and all other aliases that refer to the same original throughout the project.

Variables, which are a class of modifiers that store values, are good candidates for aliasing. For example, a variable used to contain the score in a game can be aliased and strategically placed in the project for access by specific

messengers or Miniscript modifiers. As the value of this variable changes during the game, the value of its aliases will also change, giving the modifiers efficient access to the updated score. See "Variable Scopes" on page 13.253. Aliased variables in a scene also maintain their values across scene changes in a way that unaliased ones do not. For more information, see "Persistence of Variables between Scene Changes in Built Titles" on page 13.255.

Aliasing is particularly powerful when used with the behavior modifier. If a behavior will used in many places within the project, consider making it an alias. This ensures that any changes made to any of the modifiers within the behavior will be updated in all copies of the aliased behavior.

- *Note: The names of individual copies of an aliased behavior can be changed. When the name of an aliased behavior is changed, that change affects only the individual copy of the aliased modifier. All other modifiers retain their names. To globally change the name of an aliased behavior, use the Find function to locate all copies of the alias (select "Alias" in the Find dialog's "Whose" pop-up) and change their names individually.*

Creating Aliases

An alias can be created by selecting a modifier that has been placed in the project, and choosing **Make Alias** from the Object menu (or use ⌘-M). Additional alias copies can be made by selecting and dragging the icon of the master copy from the alias palette.

To make an alias:

- Select a modifier. More than one modifier can be selected using Shift-click.
- Choose **Make Alias** from the Object menu (or use ⌘-M). The selected modifier is now an alias and the modifier icon appears dimmed. A master copy of the modifier is automatically placed in the alias palette.
- *Note: An alias can also be created simply by dragging a modifier from a component and dropping it in the alias palette window. Choose* **Alias Palette** *from the View menu (or use*

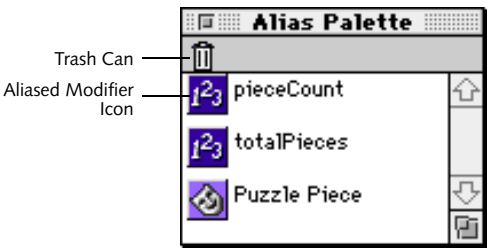


Figure 11.2 The Alias palette, containing a number of alias master copies.

⌘*-5) to view the master copies of aliases in a project.*

Alias Palette Components

The alias palette (Figure 11.2) shows the master copies of all aliases in the current project. Components of the alias palette are described below.

Trash Can

When all aliases of a master copy have been deleted from the project, drag the master copy to the trash to remove it from the alias palette.

Modifier Icons

The master copy of an aliased modifier is automatically placed in the alias palette. Shown on the palette are the modifier's icon and name.

Using Aliases

Once an alias has been created, its master copy resides on the alias palette. Creating and managing aliases is simple.

To modify an alias:

- To modify an alias such that all copies of the alias are updated, double-click any one of the instances of the alias found in the project. The modifier's dialog appears.
- *Note: Master copies of an alias cannot be edited (i.e., you cannot double-click an alias on the alias palette to display its dialog). An instance of the alias must be present in the project to edit the aliased modifier.*

To create a new alias copy:

- Drag the desired modifier from the alias palette. A new alias copy attaches to the selection tool. The master copy remains on the palette.
- Drop the alias in the desired place in the project.
- *Note: Aliases can also be duplicated using the standard* **Cut/Copy/Paste/Duplicate** *menu items or by Option-dragging an alias to a new position.*

To delete an alias from a project component:

- Select the alias and press the Delete key (or use **Cut** from the Edit menu).

To delete a master copy of an alias:

- To delete a master copy from the alias palette, first delete all of its aliases from the project, then drag the master copy to the trash alias palette's trash can.

To "break" an alias:

- An alias can be "broken" from its relationship to other instances of the alias and to the master copy in the alias palette with the **Break Alias** menu item in the Object menu. Once broken from the group, any subsequent changes to the modifier apply only to that specific modifier.

  A modifier or behavior that has been removed from the alias chain will retain its current settings until they are changed.

ASSET PALETTE

The asset palette is a visual database of the media that have been linked to a mTropolis project. This palette makes linking, storing, and copying media easy and convenient.

Select **Asset Palette** from the View menu to display the asset palette (or use ⌘-6).

Media can be displayed in the asset palette as large or small thumbnail images, or icons and names. Each item in the palette can be dragged and dropped onto elements.

Asset Palette Components

By default, all media files in the asset palette (Figure 11.3) are displayed by large thumbnails. Components of the asset palette are described below.

Trash Can

Remove unused media files from the asset palette by dragging them into the trash can. Only media files that are not being used in the project can be removed.

Show Pop-Up Menu

The Show pop-up allows the display of media files to be restricted to selected types as follows:

- **All**: Displays all types of media linked to the project.
- **PICTs**: Displays PICT files linked to the project.
- **mToons**: Displays mToons linked to the project.
- **Sounds**: Displays AIFF and snd files linked to the project. When displayed by large thumbnail, sounds can be previewed by clicking on the sound thumbnail's Play button.
- **QuickTime**: Displays QuickTime movies linked to the project.
- **Color Tables**: Displays CLUT files linked to the project.
- **All Graphics**: Displays all graphic files (PICTs, QuickTime movies and mToons) that have been linked to the project.

View By Pop-Up Menu

By default, the asset palette displays the media file as a large thumbnail. The View By pop-up provides an option for reducing the size of these thumbnails, or displaying each media file by its icon and name:

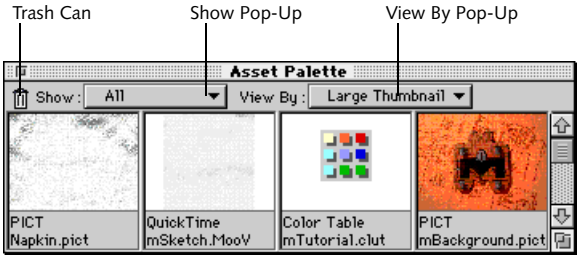
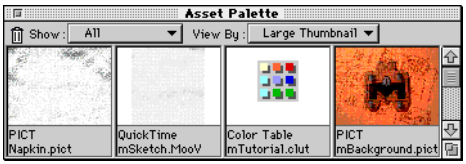
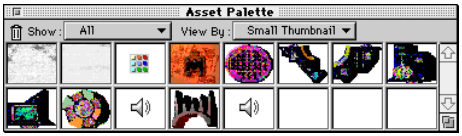


Figure 11.3 The Asset palette, showing thumbnails of available media

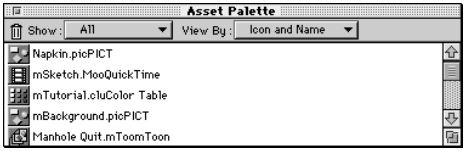
- **Large Thumbnail**: Displays a large thumbnail, the name of the file, the type of media and the number of times it is used in the project.



- **Small Thumbnail**: Displays the thumbnail at 50% size and removes the text description of the file.



- **Icon and Name**: Displays an icon related to the media type, the file's name, its media type and the number of times it is used in the project.



Linking Media to the Asset Palette

- Choose **File**, **Multiple Files** or **Folder** from the **Link Media** submenu in File menu. A standard file dialog appears. Files with valid media types are listed. Valid media types are described in "Valid Media File Types and Associated Thumbnails" on page 11.114.
- Double-click on the name of the item to be linked or click on the name of the item and click on **Link**. If multiple files are being linked, the file dialog will reappear after each selection is made. If a folder is to be linked, click on the button below the list of item names once the target folder's name appears in the button. A thumbnail of each asset appears in the asset palette.

Media can be dragged and dropped into the various views from the asset palette. When media is dropped onto a scene in this way, an element is automatically created to contain it.

Replacing Media in an Element

Media in an element can be replaced with new media from the asset palette. To accomplish this, drag and drop the media from the palette over the element.

Viewing Source File Information

To view details regarding an asset's source file, double-click on its image or icon in the asset palette. The Asset Info dialog is displayed. See "Asset Info" on page 6.66.

Valid Media File Types and Associated Thumbnails

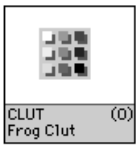
The following list shows the types of external media files supported by mTropolis, along with examples of their thumbnails.

Still image in PICT format

Animation in mTropolis mToon animation format

Movie in QuickTime format

Sounds in AIFF or snd format



Color look-up table (CLUT)

OBJECT INFO PALETTE

The object info palette (Figure 11.4) is used to view and change the size, position and layer number of elements, or to change the name of any component. The Object Info palette reports the following information about an object:

Component Name Field
This text field displays the selected component's name. This field is editable. To change the name of the component, click in this field and type a new name.

Name of Component's Parent
This non-editable text field below the component name displays the name of the component's parent. In Figure 11.4, "mBackground.pict" is the parent of "mPiece 2.mToon".

X and Y Coordinates
These values represent the position of the selected element in pixels relative to its parent. An element's origin (position (0,0) for its child) is the upper left corner of its rectangular frame.

The position of an element can be changed by dragging it to a new position in the layout window, or by entering new numbers in these editable fields.

Width and Height
The "W:" field shows the width of the selected element. The "H:" field shows its height. Values are in pixels.

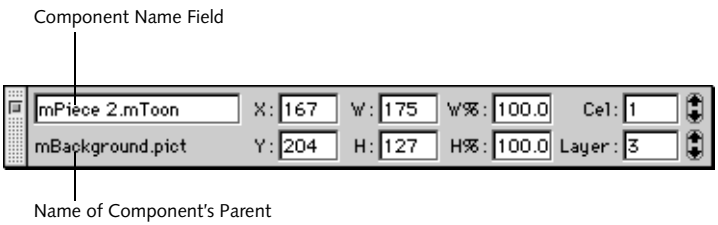


Figure 11.4 The Object Info palette

The dimensions of an element can be changed by dragging its boundaries in the layout window or by entering new numbers in these editable fields.

Relative Scale
The "W%:" and "H%:" fields display the percentage to which the image has been scaled, in width and height, respectively, relative to the original image.

The dimensions of an element can be changed by dragging its boundaries in the layout window or by entering new numbers in these editable fields.

Cel Number
The "Cel:" field identifies the current cel number of a selected mToon.

The up/down arrow buttons to the right of this field allow stepping backward or forward through the animation from a specified cel. These buttons affect the appearance of the animation in edit mode only. They allow the author to easily preview the animation without impacting how it has been configured to appear in runtime.

Layer Order Number
The "Layer:" field shows the layer order number of the selected element. Use the up/down arrows to the right of this field to select a new layer order number for the element, or enter a new number in this editable field.

If a new layer order number is assigned to an element, and that number has already been assigned to another element, the layer order numbering of elements is updated to accommodate the change. The previous occupant of the layer moves one later in the layer order. Any elements with later layer order numbers also move in a similar way.

Chapter 12. Modifier Reference

This chapter describes mTropolis' built-in modifiers. Chapter 13, "Modifier Pop-Up Menus and Message Reference" describes the Message and Message/Command pop-up menus found in all modifier dialogs. Chapter 14, "Miniscript Modifier", describes the scripting language used by the Miniscript modifier.

MODIFIERS OVERVIEW

Modifiers are special mTropolis components that modify the properties of other components in a project.

Modifiers are used by dragging them from one of the modifier palettes and dropping them on the object that they are to modify. Each modifier on the modifier palettes has unique capabilities or properties. When a modifier is dropped onto a component, the component assumes these capabilities or properties.

For example, a gradient modifier has the ability to alter the visual characteristics of graphic elements. When dropped onto a graphic element, the gradient modifier's capabilities are added to the information that makes up that object, as shown in Figure 12.1.

While some modifiers have the ability to change the visible characteristics of the elements onto which they are placed, other modifiers change invisible characteristics, or *properties,* of the element that contains them. For example, when a floating-point variable modifier that contains the value 2.5 is placed on an element, the physical representation of the element does not change, but its content, the value 2.5, becomes an intrinsic part of the element that contains it.

All modifiers can be configured (i.e., their capabilities can be customized) by changing the default settings in their modifier dialogs. In addition, most modifiers can be configured to apply their effects at specific times through a process called messaging.

A message in mTropolis can be as simple as a mouse click, or as complex as an author-defined message that is generated only after specific conditions in the runtime environment have been met. Some messages are generated by mTropolis during runtime and automatically sent to specific components throughout the project, and others can be sent

Figure 12.1 The gradient modifier, placed on a graphic element

to components from special modifiers called messengers.

For details regarding messaging within the mTropolis environment, and instructions on how to configure modifiers and messengers to respond to messages, see Chapter 13, "Modifier Pop-Up Menus and Message Reference".

MODIFIER PALETTES

The modifier palettes (Figure 12.2, Figure 12.3, and Figure 12.4) contain mTropolis' built-in modifiers. Toggle the display of these palettes on and off by selecting **Modifier Palettes-Logic**, **Modifier Palettes-Effects**, or **Modifier Palettes-Extras** from the View menu. Note that additional sets of modifiers can also be added to mTropolis. If any optional or third-party modifier "kits" have been installed, menu options for those modifier palettes will also appear in the **Modifier Palettes** cascading menu.

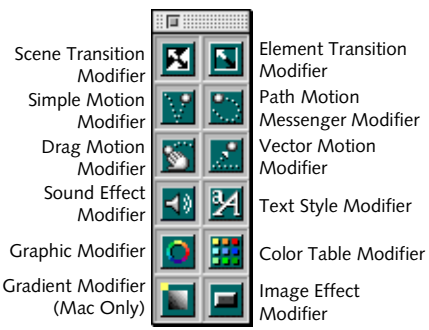


Figure 12.3 Effects Modifier Palette

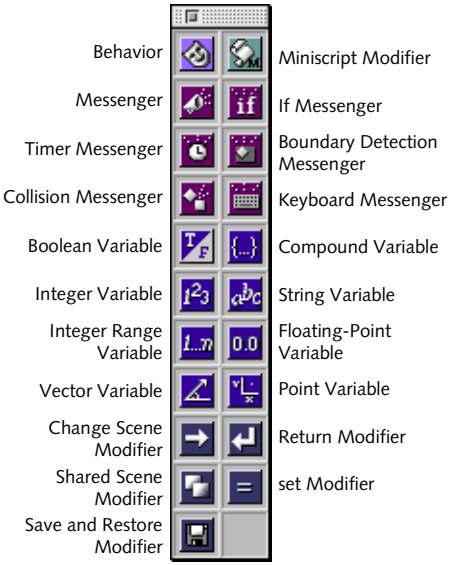


Figure 12.2 Logic Modifier Palette

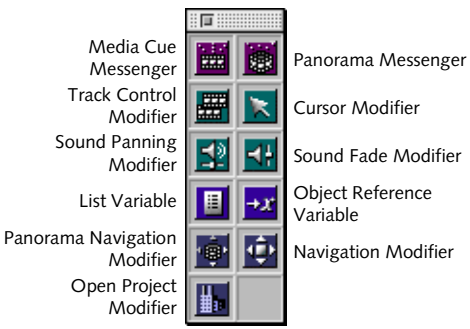


Figure 12.4 Extras Modifier Palette

Using Modifiers

Modifiers can be applied to project elements by dragging modifier icons from the palette and dropping them on their destination. The modifier becomes a child of that component.

Macintosh-only Modifiers

Some of the modifiers in this version of mTropolis work only in mTropolis titles built for the Macintosh—they have no effect in titles built for Windows platforms. These modifiers are marked with a yellow dot in the upper left corner of their icons. Be careful when using these Macintosh-only modifiers in a title that will be built for both platforms.

Names of Modifiers

To see the names of modifiers in a palette, hold down the Control key while moving the cursor over the palette.

Some notes about the names of modifiers and their use in this documentation is in order:

- The names of variable modifiers all end with the word "variable" (e.g., "boolean variable", "string variable"). In the documentation, variable modifiers are often referred to simply as "variables".
- Messenger modifiers all end with the word "messenger" (e.g., "timer messenger", "collision messenger"). In the documentation, messenger modifiers are often referred to simply as "messengers".
- To accentuate the difference between the behavior modifier, which can contain other modifiers and behaviors, and all other modifiers that cannot, the behavior modifier is often referred to simply as a "behavior".
- All other modifiers are referred to by their full names (e.g., "path motion modifier", "graphic modifier").

MODIFIER TYPES

Modifiers in the modifier palettes can be grouped into the following categories. Modifier icons have color-coded backgrounds that help to identify their category.

- Effects, which further modify the characteristics of the elements on which they are placed. Effect icons have a green background. See "Effect Modifiers" on page 12.120 for brief descriptions of the modifiers in this group.
- Variables, which store data values of various types such as text or integers. Variable icons have a purple background. See "Variable Modifiers" on page 12.121 for brief descriptions of the modifiers in this group.
- Messengers, which send messages, commands and data to specific destinations. Messenger icons have a dark red background. See "Messenger Modifiers" on page 12.122 for brief descriptions of the modifiers in this group.
- Task modifiers, which control general project features such as scene navigation, variable values, and data storage. Icons for these modifiers have a blue-grey background.

- The Miniscript modifier is a special type of modifier that provides access to mTropolis' scripting language. Depending upon the script used, a Miniscript modifier may act like an effect, messenger, or both. This modifier has a pale green background.
- The behavior modifier is a special type of modifier used to encapsulate groups of modifiers and behaviors. Optionally, a behavior can respond to messages for enabling and disabling its encapsulated modifiers. This modifier has a pale purple background.

Short descriptions of the modifier types and individual modifiers follow. Complete documentation for each modifier's dialog can be found (in alphabetical order) at the end of this chapter.

Effect Modifiers

In general, modifiers grouped under the category of effects are used to modify visible characteristics of the elements on which they are placed. Modifiers in this category include:

- **Color Table Modifier**: Manages color tables (i.e., custom color palettes). See "Color Table Modifier" on page 12.141.
- **Cursor Modifier**: Changes the mouse cursor. See "Cursor Modifier" on page 12.146.
- **Drag Motion Modifier**: Allows user element dragging. See "Drag Motion Modifier" on page 12.147.
- **Element Transition Modifier**: Activates an element transition (e.g., fade). See "Element Transition Modifier" on page 12.148.
- **Gradient Modifier**: Creates color gradients in elements. See "Gradient Modifier" on page 12.151.
- **Graphic Modifier**: Modifies graphic properties of elements (e.g., color, border shape). See "Graphic Modifier" on page 12.152.
- **Image Effect Modifier**: Creates various image effects (e.g., inverts colors of an element, adds button bevels). See "Image Effect Modifier" on page 12.156.
- **Path Motion Modifier**: Also listed as a messenger, this modifier can be used to assign motion paths to elements. Additionally, messages can be sent from any point on the motion path. See "Path Motion Modifier" on page 12.192.
- **Scene Transition Modifier**: Specifies the type of transition that will occur when the scene changes (e.g., "Zoom"). See "Scene Transition Modifier" on page 12.201.
- **Simple Motion Modifier**: Initiates a simple motion path (e.g., "Down" or "Right"). See "Simple Motion Modifier" on page 12.206.
- **Sound Effect Modifier**: Plays sound effects. See "Sound Effect Modifier" on page 12.208.
- **Sound Fade Modifier**: Decreases or increases the volume of a sound. See "Sound Fade Modifier" on page 12.210.

- **Sound Panning Modifier**: Sets the stereo position of a sound. See “Sound Panning Modifier” on page 12.212.
- **Text Style Modifier**: Modifies text styles (e.g., italics). See “Text Style Modifier” on page 12.215.
- **Track Control Modifier**: Activates and deactivates individual tracks in a QuickTime movie. See “Track Control Modifier” on page 12.219.
- **Vector Motion Modifier**: Initiates vector motion in degrees and inches per second. See “Vector Motion Modifier” on page 12.223.

Variable Modifiers

Variables store integers, strings and other values. When a variable is dropped onto a component and configured, the value contained within it can be referenced by messengers and sent with messages or commands, or referred to by name and used as variables in Miniscript programs.

Like any other modifier, variables can be given any name. For clarity, name variable modifiers to reflect their function. If the variable name will be referenced in a Miniscript modifier it is good programming practice to make the name a single word (or multiple words separated by underscore characters instead of spaces).

There are two classes of variables: simple and compound. Simple variables store a single value while compound variables store multiple values.

Variable modifiers include:

- **Boolean Variable**: Stores a true/false value. See “Boolean Variable” on page 12.133.
- **Compound Variable:** Use this modifier to create custom compound variables that can contain any combination of other variables.
- **Floating Point Variable**: Stores a floating point value (e.g., 3.14159). See “Floating Point Variable” on page 12.150.
- **Integer Variable**: Stores an integer value (e.g., 7). Possible values range from -32767 to 32767. See “Integer Variable” on page 12.158.
- **Integer Range Variable**: Stores an integer range value (e.g., 4…8). See “Integer Range Variable” on page 12.159.
- **List Variable**: Stores a list of values of any other data type. See “List Variable” on page 12.163.
- **Object Reference Variable:** Stores a reference to any object in a project. See “Object Reference Variable” on page 12.178.
- **Point Variable**: Stores a point value (e.g., (25,45)). See “Point Variable” on page 12.196.
- **String Variable**: Stores a string (e.g., “Bob Brown”). See “String Variable” on page 12.214.

- **Vector Variable**: Stores a vector value in degrees and inches per second (e.g., (33° 15.6)). See "Vector Variable" on page 12.222.

Variable Scopes

Where a variable modifier is placed defines its scope (i.e., the group of components that can access the variable). Put simply, a variable modifier is accessible to all descendants of its parent. For example, a variable modifier placed on a section is available to any modifier on the section, and all "descendants" of that section. (A parent's descendant includes any object that exists anywhere "under" it, no matter how many layers deep.)

A variable modifier whose parent is the project is called a *global variable*. Global variables can be accessed by any appropriate modifier in the entire project. See "Variable Scopes" on page 13.253. For a more localized scope, variables can be aliased and placed on specific objects anywhere in the project.

Messenger Modifiers

Messenger modifiers are used to conditionally send specific kinds of information to elements and modifiers.

Messenger modifiers include:

- **Boundary Detection Messenger**: Sends messages or commands after detecting collisions with its element's parent. See "Boundary Detection Messenger" on page 12.134.
- **Collision Messenger**: Sends messages or commands after detecting collisions with elements. See "Collision Messenger" on page 12.139.
- **If Messenger**: Sends messages and commands after a condition has been met. See "If Messenger" on page 12.154.
- **Keyboard Messenger**: Detects and responds to keystrokes. See "Keyboard Messenger" on page 12.160.
- **Media Cue Messenger**: Sends messages based upon the play position of an element's time-based media. For example, a message can be sent when an mToon starts playing a certain range. See "Media Cue Messenger" on page 12.167.
- **Messenger**: The basic messenger modifier. Sends messages and commands in response to an incoming message. See "Messenger" on page 12.171.
- **Panorama Messenger**: Detects user mouse actions over QuickTime VR panorama movies. See "Panorama Messenger Modifier" on page 12.186.
- **Path Motion Modifier**: Also listed as an effect, this modifier can be used to assign motion paths to elements. Additionally, messages can be sent from any point on the motion path. See "Path Motion Modifier" on page 12.192.
- **Timer Messenger**: Sends a message after a given time has elapsed. See "Timer Messenger" on page 12.217.

Task Modifiers

Task modifiers control project features such as scene navigation and data manipulation. Modifiers in this category include:

- **Change Scene Modifier**: Changes from one scene to another. See "Change Scene Modifier" on page 12.136.
- **Navigation Modifier**: Changes from one scene to any other scene in a project. Scenes can be selected by name or by certain relative criteria. This modifier provides a superset of the change scene modifier's functionality. See "Navigation Modifier" on page 12.174.
- **Open Project Modifier**: Opens other title or project files. See "Open Project Modifier" on page 12.183.
- **Panorama Navigation Modifier**: Changes the current view displayed by a QuickTime VR panorama. See "Panorama Navigation Modifier" on page 12.190.
- **Return Modifier**: This modifier works in association with a change scene modifier with its "add to return list" option selected. The return modifier returns the scene to the last scene which was added to the return list. See "Return Modifier" on page 12.197.
- **Save and Restore Modifier**: Writes and reads data values to an external file. See "Save and Restore Modifier" on page 12.198.
- **set Modifier**: Changes the value of a variable or incoming data to a specified value. See "set Modifier" on page 12.203.
- **Shared Scene Modifier**: This modifier changes a standard scene into the shared scene. See "Shared Scene Modifier" on page 12.205..

Behavior Modifier

A behavior is a special component in the mTropolis environment. It can be used to encapsulate (i.e., contain) groups of modifiers and other behaviors.

Behaviors can be used to group collections of modifiers that work in close concert. Each collection can be enabled or disabled with messages, creating "super modifiers" that provide more complex operations than single modifiers alone.

Like modifiers, behaviors are used by dragging and dropping them onto elements. Modifiers and other behaviors can then be dropped into them, arranged and configured for use.

The power of behaviors lies in the fact that they can be made "switchable". That is, they can be turned on or off with messages. When a behavior is switched off, all of the modifiers it encloses are disabled. When a behavior is switched on, individual behaviors or modifiers within a behavior can then be activated by incoming messages. This feature allows the author to create and control components with very sophisticated behaviors and capabilities.

Once they have been configured, the capabilities of fully functioning behaviors can be given to any other component simply by copying and pasting the variable onto the component.

Behaviors can also be aliased and placed on multiple elements in a project. Since any change made to an alias is automatically made to all other aliases of the same object, aliasing a behavior allows the author to save significant authoring time while providing complete control over multiple elements that share the same capabilities. See "Alias Palette" on page 11.110.

Behaviors, like all other components in a project, can also be stored in libraries and saved for future use in any other project. See "New, Open, and Save for mTropolis Libraries" on page 2.23.

A complete description of the behavior modifier dialog can be found in "Behavior" on page 12.129.

Miniscript Modifier

Miniscript is a simple scripting language embedded in a modifier. The Miniscript modifier allows you to use a scripting language to create customized modifiers that can:

- Get and set element attributes and variable values.
- Send messages and commands.
- Evaluate mathematical functions.
- Evaluate relational expressions and perform conditional branching.

A complete description of the Miniscript language can be found in Chapter 14, "Miniscript Modifier". A complete description of the Miniscript modifier dialog can be found in "Miniscript Modifier" on page 12.173.

ADDING MODIFIERS TO COMPONENTS

Modifiers can be added to components by dragging and dropping them from the modifier palettes.

Modifiers can be placed on objects while in any of mTropolis' three views: the layout window, the structure window or the layers window. The method for adding modifiers is the same in each case: select, drag and drop.

Once added to a component, modifiers can be customized by changing the settings in their dialogs.

To add a modifier to an element in the layout window:

- Click and drag a modifier icon from the modifier palette. A copy of the icon attaches to the cursor.
- Drop the modifier on the target element. The modifier icon appears in the top left corner of the element (or to the right of any icons already present on the element).
- Modifiers already present in a project can be moved to other components by dragging and dropping. They can be copied to other components by Option-dragging.

To remove a modifier from an element:

- Click on the modifier icon to be removed. Press the Delete key. The modifier icon, and its associated functionality, is removed from the element.
- *Note: Modifiers can also be cut, copied, pasted or duplicated in any of mTropolis' views.*

To customize a modifier:

- Double-click a modifier icon attached to an element. The modifier's dialog appears. See "Configuring Modifier Dialogs" on page 12.125 for descriptions of common modifier dialog controls. Complete descriptions of each modifier dialog can be found at elsewhere in this chapter.

CONFIGURING MODIFIER DIALOGS

The rest of this chapter contains detailed descriptions of the modifiers and their dialogs. This section describes features shared by all of the modifier dialogs.

Each of the modifiers in mTropolis has settings that can be edited through its modifier dialog. Display a modifier's configuration dialog by double-clicking on a modifier icon attached to a component.

Common Modifier Dialog Controls

Figure 12.5 shows a typical modifier dialog, the Drag Motion dialog. All the modifier dialogs are similar and share a number of common fields. These fields are described below. Complete documentation for specific modifiers is found later in this chapter.

Modifier Icon

The icon associated with the modifier appears in the upper left corner of the dialog. This icon can be used to identify the type of modifier

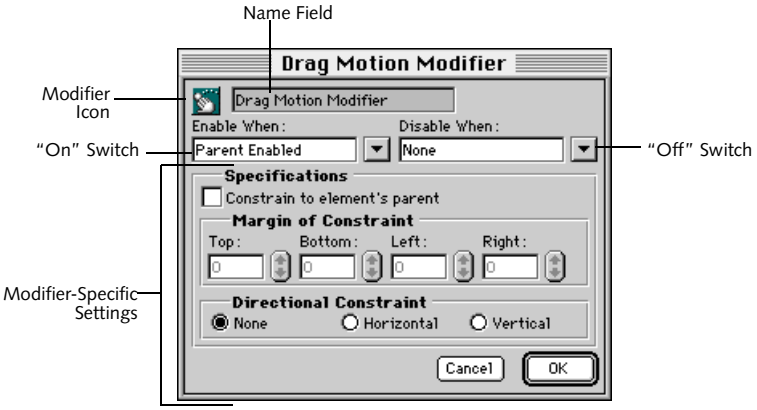


Figure 12.5 A typical modifier dialog, the Drag Motion dialog

dialog being displayed if the modifier's default name has been changed.

Name Field
This editable text field shows the name of the modifier. When first created, modifiers have a default name that is just the modifier type (e.g., "Graphic Modifier", "Messenger").

Enter a new name for the modifier here. It is good practice to use descriptive names, such as "Blue on mouse down." Descriptive naming also makes it easy to find the modifier while in the structure window. Variable modifiers that will be referenced by Miniscript, are easiest to use if they are given a single word name.

Apply (or Execute, Enable) When Pop-Up
This pop-up menu displays the message that, when received by the modifier during runtime, causes it to apply, execute, or enable its effect. In other words, this is the message that acts as an "On" switch for the modifier.

Click the down arrow button to the right of this field to display menu options. Select an item from the list, or simply type in an option and mTropolis will attempt to match it to an item in the menu. If an item cannot be matched, an alert appears, asking if you wish to create a new author message.

For a detailed description of items in this pop-up, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

Remove (or Terminate, Disable) When Pop-Up
This pop-up menu displays the message that, when received by the modifier during runtime, causes it to remove, terminate, or disable its effect. In other words, this is the message that acts as an "Off" switch for the modifier.

Click the down arrow button to the right of this field to display menu options or simply type in an option and mTropolis will attempt to match it to an item on the menu. If an item cannot be matched, an alert appears, asking you if you wish to create a new author message.

For a detailed description of items in this pop-up, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

Modifier-Specific Settings
Many modifier dialogs have settings that can be used to specify the particular action or effect to be applied.

The options for some modifiers are affected by their location in the project's hierarchy. For example, the variables available to a messenger are dependent upon where the variable modifier is placed in relation to the messenger. See "Variable Scopes" on page 13.253.

CONFIGURING MESSENGER MODIFIERS

Some modifiers are used to send specific kinds of information to other elements and modifiers. Modifiers in this group are called messengers. Although each has unique functionality, there are some similarities among them. Figure 12.6 shows a typical messenger dialog.

All messenger dialogs share the same pop-ups in their Message Specifications section:

Message/Command Pop-Up Menu
Use this pop-up to select the message or command to be sent when the messenger is activated. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

With Pop-Up Menu
Use this menu to select a value to be sent with the message or command. The choices on this pop-up are None, Incoming Data and any variables to which the modifier has access. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command.
- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its "scope."
- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.
- **Toon Ranges**: If the current scene contains an mToon that has named ranges defined, those ranges can be selected from the "Toon Ranges" submenu.

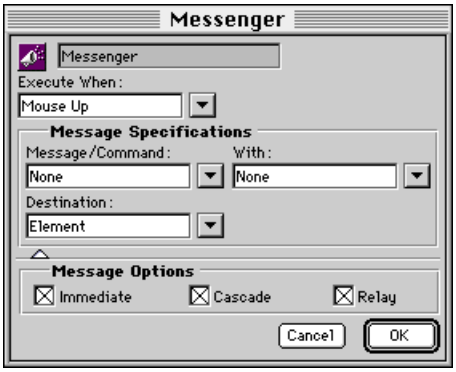


Figure 12.6 A typical messenger dialog. The "Message Specifications" and "Message Options" fields are common to all messenger dialogs.

Destination Pop-Up Menu
Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

All messenger dialogs have a Message Options section that can be revealed by clicking the triangle at the bottom of the dialog. Options in this section are:

Cascade Checkbox

By default, the message "cascades" from the targeted destination to all components in the hierarchy below it. Uncheck this option to configure the messenger to send its message only to the modifiers in a targeted component. "Cascade off" is equivalent to the path of an environment message sent by mTropolis.

- *Note: This option has no effect when sending a command. Commands act only on the targeted element.*

Immediate Checkbox

By default, messages or commands are sent immediately when the messenger is activated. Uncheck this box to configure the messenger to send its message or command only after the current thread of messages has ended. This option can be used to avoid system overload if the message thread queue becomes too deep.

Relay Checkbox

By default, messages travel from component to component in the hierarchy activating any and all modifiers that respond to the message. Uncheck this box to activate only the *first* modifier in the path of the message that is configured to respond. In effect, the first modifier to respond to the message "swallows" the message.

- *Note: This option has no effect when sending a command. Commands act only on the targeted element.*

BEHAVIOR

A behavior is a special component in the mTropolis environment. It is used to encapsulate (i.e., contain) other modifiers and behaviors.

Behaviors are used to hierarchically group collections of modifiers that work in close concert. Each collection can be enabled or disabled with messages, creating "super modifiers" that provide more complex operations than single modifiers alone.

Like modifiers, behaviors are used by dragging and dropping them onto components. Modifiers and other behaviors can then be dropped into them, and arranged and configured for use. The power of behaviors lies in the fact that they can be switchable, that is, they can be turned off or on with messages.

When a behavior is switched off, all of the modifiers and behaviors it encloses cannot be activated by incoming messages. When a behavior is switched on, individual behaviors or modifiers within a behavior can be activated by incoming messages. This feature allows the author to create and control components with highly sophisticated capabilities.

Once they have been configured, the capabilities of fully functioning behaviors can be given to any other component, simply by copying and pasting the behavior onto another component.

Behaviors can also be aliased and placed on other elements in a project. Since any change made to an alias is automatically made to all other aliases of the same object, aliasing a behavior allows the author to save significant authoring time while providing complete control over multiple elements that share the same capabilities. See "Alias Palette" on page 11.110.

Behaviors, like all other components in a project, can also be stored in libraries and saved for future use in any other project. See "New, Open, and Save for mTropolis Libraries" on page 2.23.

- *Note: Behaviors are often used simply as a tool to organize an element's modifiers into groups.*

Behaviors and Components

Behaviors, and all the modifiers they contain, are always associated with a single structural component.

To illustrate, in the figure above, Element 1 is the parent of Behavior 1 and Messenger 1, and Behavior 1 is the parent of Behavior 2 and Messenger 2. Both messengers and behaviors are, however, associated with Element 1,

which is the first structural component at the root of the modifier hierarchy.

This association is important to remember when targeting the recipient of a message from messengers within behaviors.

For example, in the figure above, when "Element's Parent" is the destination chosen for the message sent from Messenger 1, it will send its message to its associated element's parent, Scene A. This is because Element 1 is the first element at the root of the modifier hierarchy, and Scene A is this element's parent.

Using Behaviors

To create a new behavior:

- Drag a behavior modifier from the modifier palette (or a library) to an element.
- Open the behavior by double-clicking it.
- Add modifiers to the behavior by dragging them into the behavior window.
- Optionally, add modifiers to a behavior simply by dragging and dropping the modifier icons onto a closed behavior icon. When the behavior is first opened, modifiers in the behavior window can be repositioned by dragging them.

Message Passing within Behaviors

As long as a behavior is switched "on," all messages are passed to all modifiers and behaviors inside the behavior. Any modifier or behavior configured to respond to these messages will be executed. For example, if Parent Enabled were sent to the behavior depicted in Figure 12.7, the Transparent Ink and Pause modifiers would be executed but the other modifiers would not.

Messages are passed to modifiers and behaviors within a behavior according to their message passing order. This order is visible in the structure window and inside the behavior window. For more information on changing the execution order of components in a behavior, see "Messaging Order Numbers of Modifiers" on page 12.131.

Components of the Behavior Dialog

Controls in the behavior dialog are described below.

Modifier's Name Field

This editable text field can be used to change the behavior's name.

Modifier Icon

This icon identifies the modifier's type.

Switchable Checkbox

When selected, this checkbox allows the selection of enable and/or disable messages for the behavior. Select this box to create behaviors whose component modifiers are active only after the receipt of the specified "Enable When" message and are deactivated after the receipt of the specified "Disable When" message. Note that non-switchable behaviors (i.e., behaviors that do not have this checkbox checked) are always enabled.

Enable When Pop-Up Menu

This pop-up menu can be used to select the message that enables this behavior. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up

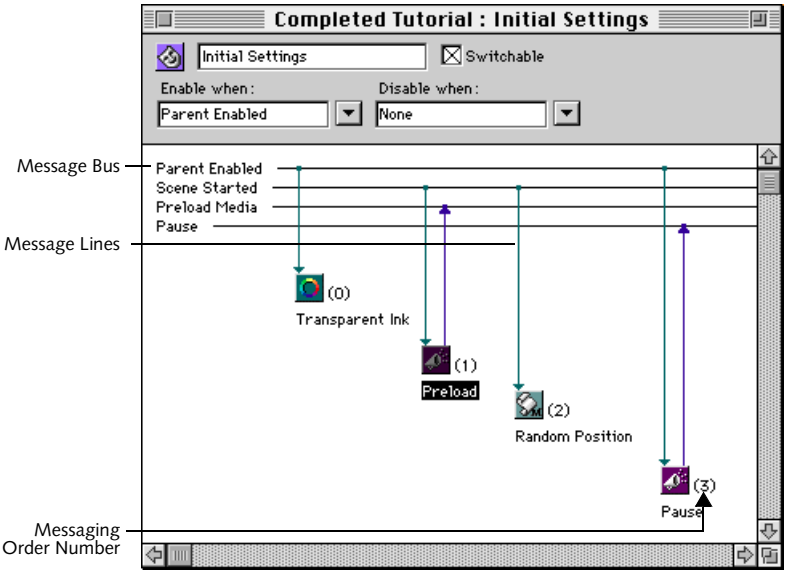


Figure 12.7 Behavior modifier dialog

Options" on page 13.229. This menu is only available when the Switchable checkbox is checked.

- *Note: With the exception of the Parent Enabled message, any message that is used to enable a switchable behavior is not broadcast to the components it contains. To enable a behavior and activate the modifiers it contains on a single message, use Parent Enabled. This message is sent by mTropolis after a scene starts.*

Disable When Pop-Up Menu

This pop-up menu can be used to select the message that disables this behavior. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229. This menu is only available when the Switchable checkbox is checked.

Names of Elements

The name of a component modifier, shown below its icon, can be changed in the behavior window by clicking on the name and entering a new one.

Messaging Order Numbers of Modifiers

These numbers, shown in brackets to the right of a component modifier's icon, denote the messaging order of modifiers within a behavior. For example, in the behavior shown in Figure 12.7. the Transparent Ink and Pause modifiers act on the same message, but Transparent Ink has a lower messaging order number than Pause and will be executed first.

The messaging order of components can be changed by clicking on the Messaging Order number. Hold down the mouse until a pop-up appears. Select Do Sooner or Do Later to move the modifier one position forward or backward in the messaging order.

Alternatively, the messaging order of modifiers and behaviors in a behavior can be changed by dragging and dropping them into new positions in the behavior from the *structure* window.

Message Bus
All messages acted on and sent by modifiers in a behavior are shown in this list. The horizontal lines extending from the messages in this list represent a message "bus" that the modifiers are "listening" to. Note that this display is not a timeline. Click on a message name to highlight its bus so that the path of the message in the behavior can be seen more easily.

Message Lines
These lines show the paths of messages to and from modifiers within the behavior. These lines connect to the message bus to show which modifiers receive and send certain messages.

On color monitors vertical message lines to and from modifiers and messages are displayed in three different colors:

- Green message lines are drawn *from* the message bus *to* a modifier, indicating the message that execute, applies, or enables the modifier.
- Blue message lines are drawn *from* a modifier or behavior *to* the message bus, indicating that the modifier sends this message when activated.
- Purple message lines are drawn *from* the message bus *to* the modifier to indicate that the message terminates, removes, or disables. These lines are also shown with an "open" (i.e., unfilled) arrow head.

For example, in Figure 12.7, the "Preload" messenger is activated by a *Scene Started* message. Upon activation, it sends a *Preload Media* message.

BOOLEAN VARIABLE

The boolean variable modifier stores a boolean (i.e., true/false) value. It is useful for keeping track of objects or properties that have only two states. For example, whether a user has touched a certain object could be stored in a boolean variable modifier; depending on the value of that variable modifier, the user may or may not be able to do something else in the project.

Components of the boolean variable dialog are described below:

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Buttons
Enter the variable's initial value here by selecting either the True or False radio button. The default is False. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

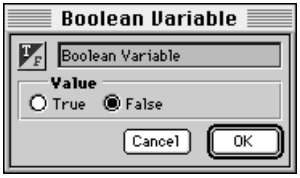


Figure 12.8 The Boolean Variable dialog

BOUNDARY DETECTION MESSENGER

The boundary detection messenger detects the relative position of elements. It can be configured to send a message when an object has left or touched the frame of its parent. For information regarding parent/child relationships, see "Parent/Child Tool" on page 11.106.

Components of the boundary detection messenger dialog (Figure 12.9) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

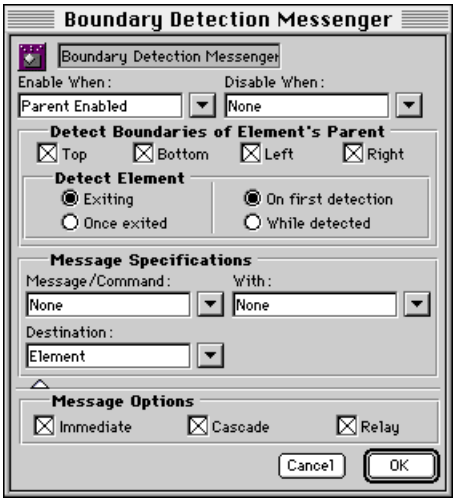


Figure 12.9 The Boundary Detection messenger dialog.

Modifier Icon
This icon identifies the modifier's type.

Enable When Pop-Up Menu
Use this pop-up menu to select the message that enables boundary detection. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Disable When Pop-Up Menu
Use this pop-up menu to select an optional message that causes boundary detection to be disabled. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Detect Boundaries of Element's Parent Checkboxes
These four checkboxes (Top, Bottom, Left, and Right) specify the boundaries of the parent element that generate messages when the child touches them. By default, all boundaries are sensitive.

Detect Element Section
The radio buttons in this section control how the child element's boundary crossing is detected:

- **Exiting**: Choose Exiting to send the specified message or command when the element is exiting its parent's boundary (i.e., there is still contact between the child and the boundary).
- **Once Exited**: Choose Once Exited to send the messenger's specified message or command when the element has completely left its parent's frame.

- **On First Detection**: Choose On First Detection to send the specified message or command when the edge of the element first touches the frame of its parent (if "Exiting" is checked) or when the element first exits (if "Once exited" is checked).
- **While Detected**: Choose While Detected to send the specified message or command each time the child moves and is touching (if "Exiting" is checked) or outside of (if "Once exited is checked) the parent's frame.

Message Specifications

Use this section to specify the message to be sent when a boundary contact is detected.

See "Configuring Messenger Modifiers" on page 12.126 or "Message Specifications" on page 12.171 for a complete description of the controls in this section.

Message Options

Click the triangle at the bottom of the dialog to display the Message Options section. See "Message Options" on page 12.128 or "Message Options" on page 12.172 for a complete description of the controls in this section.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

CHANGE SCENE MODIFIER

The change scene modifier executes a scene change when triggered in runtime mode. The previous scene, next scene, or a specific scene in the project can be selected. Note that the order of scenes in a subsection can be easily changed in the layers window—see "Changing the Order of Scenes" on page 10.98. A more complex and flexible modifier for changing scenes is described in "Navigation Modifier" on page 12.174

Components of the change scene modifier dialog (Figure 12.10) are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

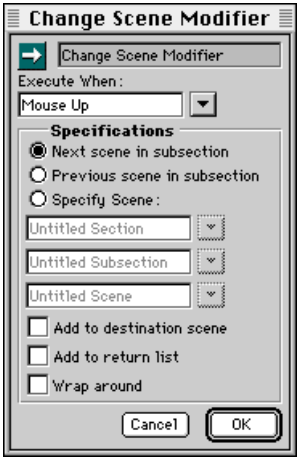


Figure 12.10 The Change Scene modifier dialog

Modifier Icon

This icon identifies the modifier's type.

Execute When Pop-Up Menu

Use this pop-up menu to select the message that triggers the scene change. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

This section of the dialog can be used to select the scene to display when the change scene modifier is triggered.

Specifications Radio Buttons

Select the type of scene:

- **Next Scene in Subsection**: Choose this option to change to the next scene in the current subsection.
- **Previous Scene in Subsection**: Choose this option to change to the previous scene in the current subsection.
- **Specify Scene**: Choose this option to activate the section, subsection and scene pop-ups. Use the pop-ups to select a specific scene anywhere in the project.

Specifications Check Boxes

Select scene change options:

- **Add to Destination Scene**: Select this checkbox to perform a special scene change in which the currently displayed scene is still visible after the change to the new scene. That is, the current scene acts like a shared scene for this scene change. Note that selecting this option automatically

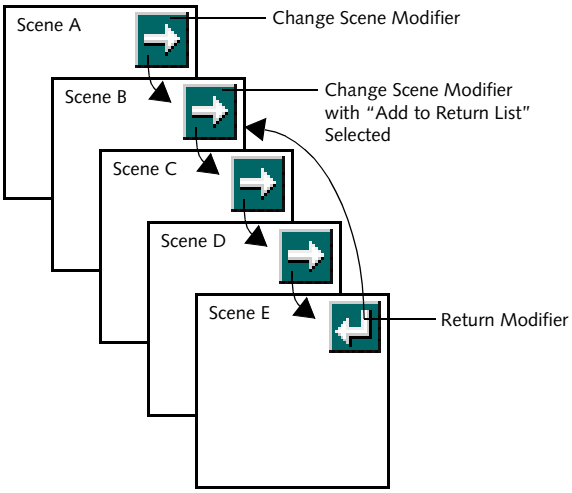


Figure 12.11 The Return List

selects the "Add to Return List" option as well.

When this option is checked and a scene change is triggered, the Scene Deactivated message is sent to the "original" scene. See "Scene Deactivated" on page 13.244. If the return modifier is used to return from the new scene to the original scene, the Scene Reactivated message is sent to the original scene. See "Scene Reactivated" on page 13.244.

Hot Tip

The "Add to Destination Scene" option can be used to simulate dialog boxes and alerts. Put elements and artwork that comprise the dialog or alert on the destination scene and ensure that this option is checked. When the scene is changed to, it looks as though the dialog has appeared "in front" of the previous scene. The return modifier can be used to "dismiss" the dialog or alert.

- **Add to Return List**: Select this checkbox to make the current scene the one returned to by the next return modifier in a series of scenes. For example, in Figure 12.11, change scene modifiers have been placed on each of the scenes. Each of these modifiers has been configured to change to the next scene. Scene B's scene change modifier has the Add to Return List option selected. A return modifier has been placed on Scene E. When this modifier receives a message that will activate it during runtime, Scene E will change to Scene B (the arrows shows the sequence of scenes).
- **Wrap Around**: By default, the first and last scene in a subsection have no connection in the scene order. That is, the last scene in a subsection has no next scene and the first scene in a subsection has no previous scene.

When this checkbox is selected, a change to the "Next Scene", executed from the last scene in a subsection, "wraps around" the list of scenes and changes to the first scene in the subsection.

Similarly, a change to the "Previous Scene", executed from the first scene in a subsection, "wraps around" the list of scenes and changes to the last scene in the subsection.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

COLLISION MESSENGER

The collision messenger is used to detect when elements are in the same space. The collision messenger sends a message when its element touches another element.

Components of the collision messenger dialog (Figure 12.12) are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

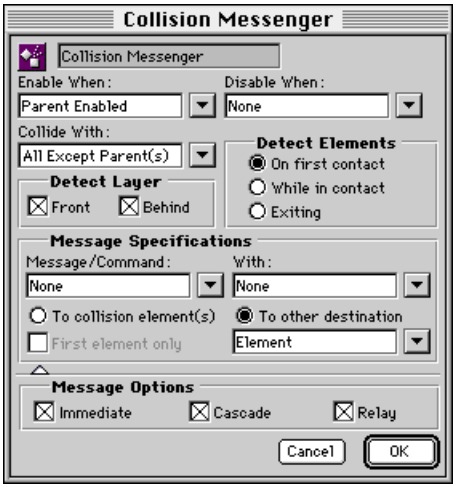


Figure 12.12 The Collision Messenger dialog

Enable When Pop-Up Menu

Use this pop-up menu to select the message that enables collision detection. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Disable When Pop-Up Menu

Use this pop-up menu to select an optional message that causes collision detection to be disabled. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Collide With Pop-Up Menu

Select the type of elements whose collision will trigger a message. There are two options.

- **Any Element**: Choose this option to send a message upon collision with any element.
- **All Except Parent(s)**: Choose this option to send a message upon collision with any element except the messenger's parent.

Detect Layer Checkboxes

By default, the collision messages are generated for collisions with elements in any layer.

- **Front**: Deselect the Front checkbox to disable collisions with objects with a higher layer order than the element (i.e., those objects that are "in front" of the element).
- **Behind**: Deselect the Behind checkbox to disable collisions with objects with a lower layer order than the element (i.e., those objects that are "behind" the element).

- *Note: If both boxes are deselected, messages will never be generated, since each object has a unique layer order number.*

Detect Elements Section
The radio buttons in this section control when messages are sent during the collision process:

- **On First Contact**: Choose this option to send the specified message or command when an object enters or makes contact with the element's frame.
- **While in Contact**: Choose this option to send the message or command repeatedly while a moving object is in contact with the element.
- **Exiting**: Choose this option to send the message or command when a colliding object leaves the element's frame.

Message Specifications Section

Use this section to specify the message to be sent when a boundary collision is detected. See "Configuring Messenger Modifiers" on page 12.126 or "Message Specifications" on page 12.171 for a description of the common controls in this section.

The collision detection dialog has a number of unique message specifications that control the destination of messages sent by the collision modifier:

To Collision Element(s) Radio Button
When this option is selected, messages are sent only to the objects that collide with the element.

First Element Only Checkbox
This option is only available when the "To collision element(s)" radio button is selected. When the First Element Only checkbox is selected, a message is sent only to the first object that collides with the modified element.

To Other Destination Radio Button
Select this option to send collision-generated messages to other destinations. A destination pop-up is activated. The selected destination is the only recipient of messages generated by collisions with the element.

Message Options
Click the triangle at the bottom of the dialog to display the Message Options section. See "Message Options" on page 12.128 or "Message Options" on page 12.172 for a complete description of the controls in this section.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

COLOR TABLE MODIFIER

Often, 8-bit graphic media (i.e., 256 color media) are designed using a color table other than the standard Macintosh system color table. Though any number of color tables can be used in a project, only one color table can be displayed at a time. The color table modifier allows you to define which color table is to be active at any one time.

A complete description of mTropolis' color table handling follows the description of the color table modifier.

Components of the Color Table Modifier Dialog

Components of the color table modifier dialog (Figure 12.13) are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

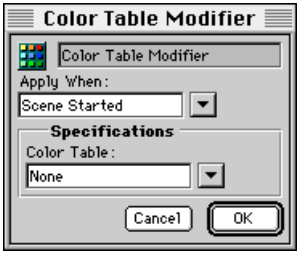


Figure 12.13 The Color Table modifier

Apply When Pop-Up Menu

Use this pop-up menu to select the message that applies the color table modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Color Table Pop-Up Menu

Use this pop-up to select the name of a color table file that has been linked to the current project. New color tables can be linked by choosing **Link Color Table**. A standard file dialog appears. Select a CLUT file to be linked.

A set of CLUT files that contain commonly-used color tables (e.g., Windows System Palette, Grayscale Palette, etc.) can be found in the **Color Tables** folder of the mTropolis distribution.

Cancel Button

Click Cancel to ignore changes made to this modifier.

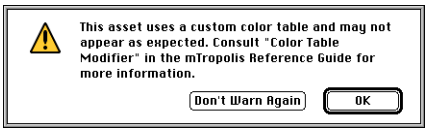
OK Button

Click OK to accept changes made to this modifier.

HOW mTROPOLIS HANDLES COLOR TABLES

By default, mTropolis projects use an 8-bit offscreen buffer. That is, projects are designed to be run on 8-bit (256 color) displays. This option is a project preference that can be changed (see "Color Depth Pop-Up Menu" on page 3.51). In a 256 color project, *color tables* (also called *color palettes*) are used to define *which* 256 colors—out of the total range of visible colors—can be used.

When an 8-bit image that uses a color table other than the Macintosh 8-bit system color table is linked to a project, the alert shown below is displayed:



This alert appears because, by default, mTropolis uses the Macintosh 8-bit system color table to display images. Images that use custom color tables may appear wildly different when displayed using the Macintosh system color table.

Applying Color Tables in Runtime Mode

To make the image display properly, put a color table modifier in the same scene as the image. Link the appropriate color table to the modifier and configure the modifier as described below. When activated during runtime, the selected color table will be applied to the scene and the graphic will display properly.

Applying Color Tables in Edit Mode

By default, mTropolis uses the **Macintosh 8bit** color table to display graphics during edit mode. If other color tables have been linked to the project (through the use of the color table modifier or Asset Palette), those color tables can be used to display graphics in edit mode by selecting them from the **View - Preview Color Table** cascading menu. See "Preview Color Table" on page 7.78.

Creating Custom Color Tables

To create a custom color table for an 8-bit image, use an image editing application to extract the color table and save it as a CLUT file. To save a CLUT file from Adobe Photoshop, use the following steps:

- Start Photoshop and open the desired 8-bit image.
- Select **Color Table** from Photoshop's **Mode** menu. The Color Table dialog appears, showing the custom color table used by the image.
- Click the Color Table dialog's **Save** button. A file selection dialog appears. Enter a name for the color table and click **Save**. The color table is saved as a CLUT file, suitable for use with mTropolis.

To use a custom color table with multiple images or entire projects, it is usually best to create the color table first, then create images using only the colors in that color table. Alternatively, existing graphics can be re-mapped to the custom color table. Programs such as Equilibrium's DeBabelizer include features for creating optimal color tables from multiple 8-bit images.

Color Tables and Projects that Use Thousands or Millions of Colors

When linked to a project that supports Thousands or Millions of colors (see "Color Depth Pop-Up Menu" on page 3.51), 256 color images exhibit the same behavior as described above for 8-bit projects. That is, such graphics are *not* displayed with their

native color tables. To properly display 8-bit images in a 16-bit or 24-bit color project without having to use the color table modifier, use an image editing application to convert the graphics to the appropriate bit depth *before* importing them into mTropolis. To perform this type of conversion in Adobe Photoshop, use the following steps:

- Start Photoshop and open the desired 8-bit image.
- Select **RGB Color** from Photoshop's **Mode** menu to convert the image from the Indexed Color (8-bit color) model to a 24-bit color model.
- Select **Save As** from Photoshop's **File** menu. A file selection dialog appears. Enter a filename for the new image and select **PICT File** from the dialog's **Format** pop-up menu. Click the dialog's **Save** button.
- The PICT File Options dialog appears. Select the appropriate **Resolution** for the image. Select **16-bits/pixel** to create an image with Thousands of colors. Select **32-bits/pixel** to create an image with Millions of colors.

Note that the resulting file will be larger than the original file because more bits are needed to represent the image in its new color model. As a result, these images will take up more space in the mTropolis built title file.

COMPOUND VARIABLE

The compound variable modifier can be used to organize a number of other mTropolis variables into a single, user-defined compound variable. The fields of custom compound variables created with this modifier can be accessed from Miniscript in the same way as mTropolis' built-in compound variables. See "Variables" on page 14.259 and "Accessing the Fields of Compound Variables" on page 14.260.

To use the compound variable modifier, place it on a component, then drag variables onto its icon. The variables will seem to "disappear" into the compound variable. To view the contents of the compound variable, switch to the structure view and toggle the compound variable's open/close triangle to reveal the variables that have been placed inside.

The name given to the compound variable is its "top-level" name. The names of the individual variables put inside the compound variable become the names of the variable's fields. See the example below.

Note that compound variables can be nested inside other compound variables to create complex data hierarchies. Like any other variable, the compound variable modifier can also be sent or received as data by any messenger in its scope.

Hot Tip

Use this variable in conjunction with list variables (see "List Variable" on page 12.163) to create various types of multidimensional arrays.

Components of the compound variable dialog are described below.

Variable's Name Field
This editable text field can be used to change the variable's name. This name becomes the "top-level" name of the compound variable. Any variables dropped into the compound variable become "fields" of the custom compound variable. See the example below.

Modifier Icon
This icon identifies the modifier's type.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

Example

Consider the structure view of the compound variable shown in Figure 12.15. The compound variable has been given the name "client". There are two variables that have been placed inside the compound variable—a string variable and an integer variable. The names of these variables, "name" and "age",

Figure 12.14 The Compound Variable dialog

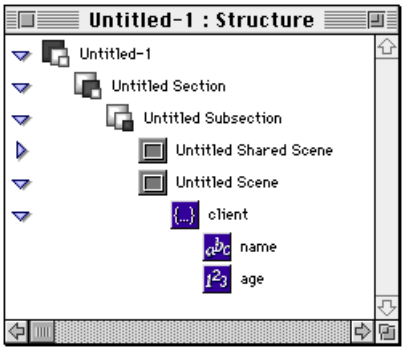


Figure 12.15 Structure view of example compound variable

become the names of the compound variable's fields.

Values in the compound variable can be accessed through Miniscript statements. For example, the entire compound value can be accessed by using its "top-level" name in a Miniscript statement:

```
send "NewClient" with client
```

The values of individual variables within the compound variable can be accessed just like the fields of "built-in" compound variables using the "." syntax. In our example, the Miniscript expression `client.name` resolves to the string value contained within the "name" string variable. Similarly, the expression `client.age` resolves to the integer value contained in the "age" integer variable.

These values could be used with any type of Miniscript statement. The following examples illustrate just a few of the possibilities:

```
-- Set the value of a variable from
-- one of the fields:
set mytextvar to client.name

-- Change the value of a field:
set client.age to 27

-- Perform a comparison using a field:
if client.age < 21 then \
   send "No Cocktails for You"

-- Set the value of an attribute
-- from a field:
set mytextelement.text to \
   "Good job, " & client.name
```

Miniscript statements are described in Chapter 14, "Miniscript Modifier".

CURSOR MODIFIER

The cursor modifier changes the active mouse cursor on receipt of a specified message. Its effects are only visible during runtime.

Components of the cursor modifier dialog (Figure 12.16) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Apply When Pop-Up Menu
Use this pop-up menu to select the message that causes the cursor to change. The default is Mouse Over, which makes the cursor change when it is moved over the element. The cursor remains changed until the message specified in the "Remove When" pop-up is received, or another cursor modifier is activated.

- *Note: The newly-specified cursor is not actually applied immediately after the receipt of the message specified in this pop-up. The cursor must be moved before the change takes effect. When the cursor modifier is applied upon receipt of a message such as Mouse Over, this behavior is not noticeable. However, in situations where this behavior is a problem, the cursor can be forced to change without having to wait for user mouse actions. See "refreshCursor" on page 15.290.*

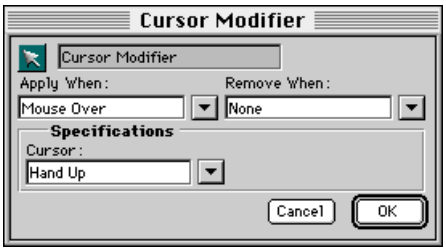


Figure 12.16 The Cursor Modifier dialog

For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Remove When Pop-Up Menu
Use this pop-up menu to select the message that causes the cursor to revert to the default system cursor. Note that when multiple cursor modifiers are applied sequentially, the cursor *does not* revert to the previously-applied cursor, but *always* reverts to the system cursor.

For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Cursor Pop-Up Menu
Use this pop-up menu to select a cursor to be changed to when the specified "Apply When" message is received. This list contains the names of many different cursor selections.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

DRAG MOTION MODIFIER

The drag motion modifier allows an element to be dragged around the screen by the user during runtime.

Components of the drag motion modifier dialog are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Enable When Pop-Up Menu

Use this pop-up menu to select the message that enables dragging of the element. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Disable When Pop-Up Menu

Use this pop-up menu to select the message that disables dragging of the element. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

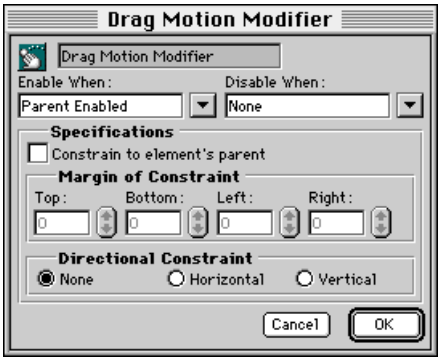


Figure 12.17 The Drag Motion modifier dialog

Specifications Section

Use the controls in this section of the dialog to set drag motion options.

Constrain to Element's Parent Checkbox

Check this box to make the object draggable only within the limits of its parent's frame.

Margin of Constraint Fields

These options are available when "Constrain to Element's Parent" is selected. They set a "margin" inside the frame of the element's parent that constrains drag motion even more. Margins can be set for the Top, Bottom, Left, and Right sides of the parent frame. Margins are measured in pixels.

Directional Constraint Radio Buttons

Use these options to constrain drag motion to a single direction. Options are:

- **None**: The default. Select this option to allow dragging in any direction.
- **Horizontal**: Select this option to allow horizontal dragging only.
- **Vertical**: Select this option to allow vertical dragging only.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

ELEMENT TRANSITION MODIFIER

The element transition modifier can be used to creatively hide or reveal an element. Like the scene transition modifier, the transition pop-up lists optional effects, such as fade and rectangular iris.

Components of the element transition modifier dialog are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that enables the element transition. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

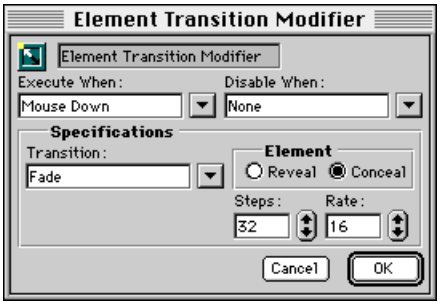


Figure 12.18 The Element Transition modifier dialog

Disable When Pop-Up Menu
Use this pop-up menu to select the message that disables the element transition. Note that a transition cannot be cancelled while it is being played. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to select the type of element transition.

Transition Pop-Up Menu
Select a transition type from this menu. Options include:

- Fade
- Rectangular Iris
- Zoom
- Oval Iris: Note that this option is only supported in titles built for the Macintosh platform—in titles built for Windows platforms, this transition is replaced with the "Rectangular Iris" transition.

Element Radio Buttons
The transition can reveal a hidden element or hide a visible element:

- **Reveal Element**: Select this option to reveal a currently hidden element. If this option is selected for a visible element, the element will be hidden at the start of the transition.
- **Conceal Element**: Select this option to hide a currently visible element.

Steps Field
Use this field to set the number of steps between the start and finish of the transition. The greater this number, the finer (and slower) the transition.

Rate Field
Use this field to select the speed of the transition in steps per second. At a rate of 60, a transition set to 60 steps would take 1 second.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

FLOATING POINT VARIABLE

Floating-point variables store floating-point values. Floating-point values have a range of $\pm 10^9$-1 and accuracy to 8 places. Floating-point values are useful in mathematical computations.

Components of the floating-point variable dialog are described below:

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Field
Enter the variable's initial value here or use the up/down arrow buttons to set the value by 0.5 increments. The value is checked for validity when the OK button is clicked. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

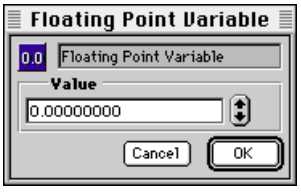


Figure 12.19 The Floating Point variable dialog

GRADIENT MODIFIER

The gradient modifier produces a color gradient between two colors on any graphic element that has not been linked to an external file (i.e., an "empty" graphic element).

- *Note: The gradient modifier is currently supported only on the Macintosh (as indicated by the yellow dot in the icon's upper left corner). This modifier will have no effect in a title built for the Windows platform.*

Components of the gradient modifier dialog (Figure 12.20) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Apply When Pop-Up Menu
Use this pop-up menu to select the message that applies the gradient modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

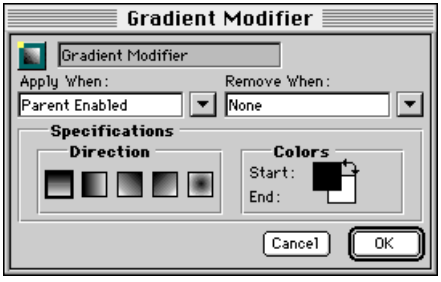


Figure 12.20 The Gradient Modifier dialog

Remove When Pop-Up Menu
Use this pop-up menu to select the message that removes the gradient modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Direction Buttons
Click one of the sample gradient buttons to select a direction/style for the gradient.

Start and End Color Boxes
These boxes display the start and end colors of the gradient. Click and hold on a square, and drag to a color on the palette that appears. To reverse the direction of the gradient, click on the arrow that points to both color squares.

- *Note: Regardless of the bit depth of your project, gradients produced with this modifier are always 8-bit gradients. Some gradients, especially those between very different colors, may look "banded" or dithered.*

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

GRAPHIC MODIFIER

The graphic modifier applies basic shapes, color, ink effects, borders and shadows to graphic elements. It can also be used to define the matte color and borders of elements. Elements can have multiple graphic modifiers, but the effects of only one graphic modifier are active at once.

Note that some of the effects made possible by this modifier can also be selected using tools on the tool palette. See "Ink Effects" on page 11.107, and "Foreground and Background Colors" on page 11.109.

Components of the graphic modifier dialog (Figure 12.21) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

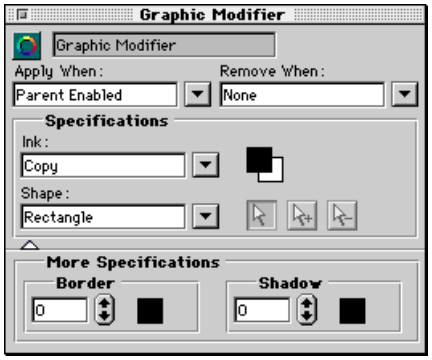


Figure 12.21 The Graphic Modifier Dialog

Modifier Icon
This icon identifies the modifier's type.

Apply When Pop-Up Menu
Use this pop-up menu to select the message that applies the graphic modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Remove When Pop-Up Menu
Use this pop-up menu to select the message that removes the graphic modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to select the type of graphic effect to apply.

Ink Pop-Up Menu
The ink effect changes the way a graphic element is displayed on the screen. Different inks have varying effects, depending on the color(s) of the object itself, and the object beneath it. Options in this pop-up are the same as those described in "Ink Effects" on page 11.107. The foreground/background color boxes to the right of this menu work the same way as those described in "Foreground and Background Colors" on page 11.109.

Shape Pop-Up Menu
Use this menu to create or edit the "hot" region of the object. Areas not enclosed in the shape do not respond to mouse messages. Available shapes are:

- **Rectangle**: The default shape. The graphic completely fills its rectangular frame.
- **Round Rectangle**: The graphic takes a rectangular shape with rounded corners.
- **Oval**: The graphic takes an oval shape. If the frame of the graphic is square, the shape looks like a perfect circle.
- **Star**: The graphic takes a five-pointed star shape.
- **Polygon**: The Polygon option allows an author-definable irregular shape around an object within the element. To define the polygon region, use the tools to the right of the Shape pop-up. Note that polygon shapes should be created *within* the original rectangular bounding box. Polygon points created outside the rectangular border are ignored and the element is instead clipped to its original boundary.

Polygon Shape Tools

These tools are active when Polygon is selected in the Shape pop-up:

Point Selection Tool: Use this tool to drag a polygon point to a new location.

Add Point Tool: Use this tool to add a new point to the polygon. Click on the polygon outline to add a new point.

Delete Point Tool: Use this tool to delete a point on the polygon. Click on a polygon point with this tool to delete the point.

More Specifications Section

Click the white triangle at the bottom of the graphic modifier dialog to toggle the display of these options:

Border Field

Use this field to specify the size, in pixels, of a border around the defined shape of the element. Use the color box to the right of this field to select a color for the border.

Shadow Field

This option adds a shadow effect to the object of the color chosen in the box to the right.

IF MESSENGER

The "if" messenger is very similar to the standard messenger modifier, except that it only sends its message or command if a specified condition is true.

The messenger evaluates a boolean expression, entered in Miniscript syntax in the dialog's "If" scrolling text field. This expression is evaluated when the messenger receives its "Execute When" message. If the expression evaluates to "true", the message or command specified in the Message Specifications section is sent. Otherwise, no message is sent.

Components of the "if" messenger dialog (Figure 12.22) are described below:

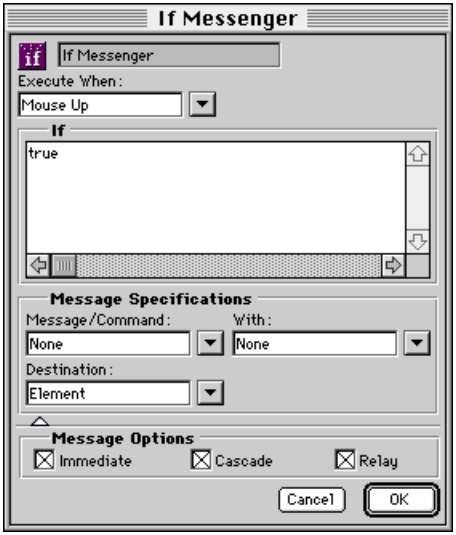


Figure 12.22 The If Messenger dialog

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that causes the "If" expression to be evaluated. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

If Expression Scrolling Text Field
Enter a boolean expression in this field; use standard boolean and relational operators, reserved variables, functions and/or author-defined variables. This expression must be in proper Miniscript syntax. See "Miniscript Modifier" on page 14.257. The syntax of the expression is checked when OK is clicked.

If the expression evaluates to true (see "Definition of True" on page 14.267), the message specified in the Message Specifications section is sent. Some sample 'if' expressions follow:

- The following expression evaluates to true if the user-defined variable `cel` is equal to 5:

```
cel=5
```

- The following expression evaluates to true if the user-defined boolean variable `userCanDo` contains true:

```
userCanDo
```

- The following expression evaluates to true if the user-defined string variable `userName` contains the string “super”:

```
userName = "super"
```

Message Specifications
Use this section to specify the message to be sent if the expression in the “If” scrolling text field evaluates to true.

See “Configuring Messenger Modifiers” on page 12.126 or “Message Specifications” on page 12.171 for a complete description of the controls in this section.

Message Options
Click the triangle at the bottom of the dialog to display the Message Options section. See “Message Options” on page 12.128 or “Message Options” on page 12.172 for a complete description of the controls in this section.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

IMAGE EFFECT MODIFIER

The image effect modifier can apply one of a number of predefined graphic effects to an element. These effects are particularly useful when creating elements that represent clickable buttons.

Components of the image effect modifier dialog are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Apply When Pop-Up Menu

Use this pop-up menu to select the message that applies the effect. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

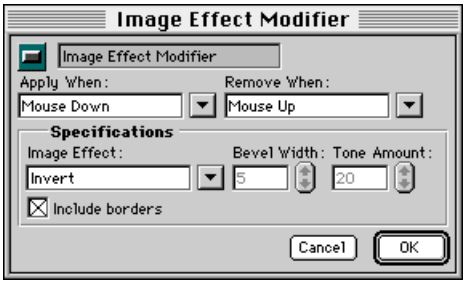


Figure 12.23 The Image Effect modifier dialog

Remove When Pop-Up Menu

Use this pop-up menu to select the message that removes the effect. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to select the effect to be applied.

Image Effect Pop-Up Menu

Use this pop-up to select an image effect. Options include:

- **Invert**: This option causes the color of the element to invert, that is, the opposite color of the element will be applied.
- **Selected Bevels**: This option applies a 3D beveled edge effect to the element. The width of the bevel edge and the tone of the color to be applied to the edge is specified in the Bevel Width and Tone Amount fields.
- **Deselected Bevels**: This option applies an indented 3D beveled edge effect to the element. The width of the bevel edge and the tone of the color to be applied to the edge are specified in the Bevel Width and Tone Amount fields.
- **Tone Down**: This option darkens the tone of the element's color according to the value specified in the Tone Amount field.
- **Tone Up**: This option lightens the tone of the element's color according to the value specified in the Tone Amount field.

Bevel Width Field
Use this field to select a width of the bevel, in pixels, when a bevel effect is selected. The up/down buttons increase or decrease the bevel size by 1 pixel. This field is active only when a bevel effect is selected.

Tone Amount Field
Use this field to select the severity of the selected effect. The up/down arrow buttons increase or decrease the tone in increments of 1%. This field is active for all effects except Invert.

Include Borders Checkbox
Select this option to apply the image effect to an element's border and/or shadow effect (if it has one). See "Border Field" on page 12.153 and "Shadow Field" on page 12.153.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

Hot Tip

Use multiple image effect modifiers to create a bevel-edged 3D-button effect: one to show the regular state of the button, one to show it depressed and one to reset it to its regular state.

INTEGER VARIABLE

The integer variable modifier holds integer values. Integer variables are "long integers" with a range of ±2147483648. Integer variables are useful as counters or in mathematical computations.

Components of the integer variable dialog (Figure 12.24) are described below:

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Field
Enter the variable's initial value here or use the up/down arrow buttons to set the value. The value is checked for validity when the OK button is clicked. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

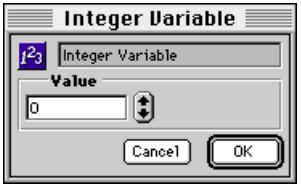


Figure 12.24 The Integer Variable dialog

INTEGER RANGE VARIABLE

An integer range variable is used to hold an integer range value. These values are especially useful for storing ranges of cels in an "mToon" animation. See "The mToon Menu" on page 2.26 for more information on mToons.

Components of the integer range dialog are described below.

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Fields
Enter the variable's initial values here. The input field on the left represents the start value. The input field on the right represents the end value. Highlight a field and enter a value or use the up/down arrow buttons to change the value of the field.

The value is checked for validity when the OK button is clicked.

- *Note: If this range is to be used with an mToon, the start and end values should be less than the number of cels in the animation being controlled.*

The values can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

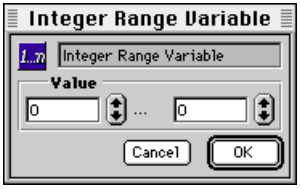


Figure 12.25 The Integer Range dialog

KEYBOARD MESSENGER

The keyboard messenger generates messages when a specified keyboard event, such as a keypress, is detected.

The keyboard messenger dialog (Figure 12.26) is described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Execute When Section

The controls in this section select the type of keyboard event to be detected. Select a key and key state:

Figure 12.26 The Keyboard Messenger dialog

Key Section

In the pop-up menu field, enter the key that causes this messenger to execute. Alternatively, use the pop-up menu to select one of the special keys described below:

- **Any**: Any keypress activates the modifier.
- **Return**: The main keyboard "Return" or "Enter" key not to be confused with the "Enter" key found on the numeric keypad. On Macintosh, this is the key is marked "Return". On Windows, this is the same key, often marked "Enter".
- **Enter**: The "Enter" key found on the numeric keypad.
- **Tab**: The Tab key.
- **Backspace**: The "Backspace" or "Delete" key, not to be confused with "Del", the forward delete key.
- **Arrow Left**: The left arrow key.
- **Arrow Right**: The right arrow key.
- **Arrow Up**: The up arrow key.
- **Arrow Down**: The down arrow key.
- **Escape**: The "Escape" or "Esc" key.
- **Home**: The "Home" key.
- **End**: The "End" key.
- **Help**: On Macintosh, the "Help/Ins" key. On Windows, this key is mapped to F1 (because F1 is commonly used as a keyboard shortcut for displaying help).

There is currently no mapping to the Windows "Insert" key.

- **Page Up**: The "Page Up" key.
- **Page Down**: The "Page Down" key.
- **Del**: The forward delete key, marked "Del" or "Delete".

Select the Control, Command or Option key checkbox, if desired. Note that both Command and Option are mapped to the "Alt" key on Windows platforms.

Key State Radio Buttons

Select the type of key event to be detected. The keyboard messenger can detect the state of the key being pressed. The default state is key down, but the other choices allow for greater functionality:

- **Down**: The message or command is sent when the key is first pressed down.
- **Up**: The message or command is sent when the key is released after having been pressed.
- **Repeat**: The message or command is repeatedly sent while the key continues to be held down (i.e., while key repeat is activated). Note that this selection does not generate a message when the key is *first* pressed.

Message Section

Use the controls in this section to specify the message to be sent when a keyboard event is detected.

Message/Command Pop-Up Menu

Use this pop-up to select the message or command to be sent when the messenger is activated. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

With Pop-Up Menu

Use this menu to select a value to be sent with the message or command. The standard choices are available, but the "Incoming Data" menu option is slightly different when used with this modifier. When the specified keyboard event causes this modifier to execute, the value of the key that was pressed is sent to the keyboard messenger as incoming data. Select "Incoming Data" to send that key value with the selected outgoing message. Note that this key value can only be accessed by the Miniscript modifier. The value cannot be properly interpreted by other modifiers. The Miniscript **`incoming`** keyword can be used to access the key value where it is interpreted by Miniscript as a string. For example, the following Miniscript statement would display the pressed key in a text element named "mytext":

```
set mytext.text to incoming
```

Destination Pop-Up Menu

Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

Click the triangle at the bottom of the dialog to display the Message Options section. See

"Message Options" on page 12.128 or "Message Options" on page 12.172 for a complete description of the controls in this section.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

LIST VARIABLE

The list variable modifier is a compound variable that can be used to store a list of values of the same data type. Values can be added to and deleted from the list dynamically via Miniscript statements. Other Miniscript statements can be used to sort the list, randomly shuffle the individual list elements, return the number of elements in a list, or return randomly-selected values from the list.

Note that the list variable dialog is used only for creating a list variable, naming it, and declaring the data type of its list elements. Adding values to a list or otherwise manipulating its contents must be performed through Miniscript statements (see "Miniscript Syntax for List Variables" on page 12.163 and Chapter 14, "Miniscript Modifier"). The contents of a list cannot be seen or set in any of mTropolis' editing views.

Components of the list variable dialog (Figure 12.27) are described below.

Figure 12.27 The List Variable dialog

Variable's Name Field

This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon

This icon identifies the variable modifier's type.

List Type Pop-Up Menu

Use this pop-up menu to select the data type of the list elements.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

Miniscript Syntax for List Variables

The individual elements of a list can be accessed and manipulated through Miniscript statements as described below.

Basic List Syntax

Individual elements of a list can be referenced by using the following syntax:

```
listname[n]
```

where *listname* is the name of the list, as specified in its name field and *n* is an integer from 1 to the total number of list elements. For example, to retrieve the value of the third element of the integer list variable `myIntList` and store it in the variable `myInt`, use the statement:

```
set myInt to myIntList[3]
```

An entire list is represented by a comma-separated list of values enclosed in curly brackets:

```
{value1, value2, ..., valuen}
```

where the value of the *n*th element is specified by $value_n$.

Creating the Contents of the Entire List

To create and set the contents of an entire list at once, use the syntax:

```
set listname to {v1, v2, ..., vn}
```

where *listname* is the name of the list and the comma-separated list of values enclosed in curly brackets are the values to be assigned to elements 1 through *n*. Note that when this syntax is used, any previous values held by the list are lost—the list's values and total number of elements change to conform to the specified list.

For example, the following statement creates a four-element integer list:

```
set myIntList to {10, 20, 30, 100}
```

After execution of this statement, the first element of `myIntList` will contain 10, the second will contain 20, the third will contain 30, and the fourth element (the last one in the list) will contain 100.

Changing the Value of a List Element

To change a single value in a list, use the **`set`** statement to assign a value to the desired element number in the list:

```
set listname[n] to value
```

where *listname* is the name of the list, *n* is the element's position in the list (starting at 1), and *value* is a data value of the correct type. A new list element is created at the specified position in the list. Note that if *n* exceeds the total number of elements in the list (i.e., the *n*th element does not exist), the *n*th element is created with the specified value, but intermediate elements are also created and assigned a default value of 0 (or null for string values). For example, consider the following statement, executed when `myIntList` contains no elements:

```
set myIntList[3] to 10
```

List element 3 will be created and assigned the value 10, but elements 1 and 2 will also be created and assigned the default value of 0.

Inserting a List Element

Instead of changing the value of an existing list element, a new value can be inserted at any position in the list, causing the current element at that position (and any subsequent elements) to move one position later in the list. To insert an element, use the **`set`** statement with the list's `insert` attribute as follows:

```
set listname.insert[n] to value
```

where *listname* is the name of the list, *n* is the desired position of the new element and *value* is the data value to be stored in the new list element. For example, consider the following Miniscript statements that refer to an integer list variable, `myIntList`:

```
-- create a three-element list
set myIntList to {10, 20, 30}
```

```
-- insert a new element at the
-- second position
set myIntList.insert[2] to 100
```

After executing these statements, `myIntList` would contain the list `{10, 100, 20, 30}`.

Deleting a List Element

To delete an element from a list and return the deleted value (i.e., as if "popping" the element out of the list), reference the list's `delete` attribute in a Miniscript expression with the following syntax:

```
listname.delete[n]
```

where *listname* is the name of the list and *n* is the number of the element to be deleted from the list. The element is removed from the list, any later elements in the list are moved to one position earlier in the list to fill the gap, and the expression resolves to the value that was stored in the deleted element. For example, consider the following Miniscript statements that refer to a string variable, `myString`, and a string list variable, `myList`:

```
-- create a three-element string list
set myList to {"one", "two", "three"}

-- remove the second element from
-- the list
set myString to myList.delete[2]
```

After executing these commands, `myString` would contain the string value `"two"` and `myList` would contain the list `{"one", "three"}`.

- *Note: Attempting to delete an item that doesn't exist (e.g., attempting to delete element 4 of a 2-element list) causes an error that halts Miniscript execution.*

Returning the Number of Elements in a List

The `count` attribute of a list variable stores the current number of elements in the list. Therefore, the Miniscript expression:

```
listname.count
```

where *listname* is the name of the desired list, resolves to the number of elements in the list. For example, the number of list elements could be retrieved with a statement such as:

```
set myInt to myIntList.count
```

Because the `count` attribute is writable, the number of list elements can also be changed by setting `count` to a new value. For example:

```
set myIntList.count to 10
```

Note that, if the new value of `count` is less than the previous value, the list is truncated, but remaining elements retain their previously stored values. If the new value of count is greater than the previous value, new elements are created past the end of the previous list. These new elements contain the default value of 0 (or null for strings).

Returning a Randomly-Selected Value from a List

To return a randomly-selected value from a list, reference the list's random attribute:

```
listname.random
```

where *listname* is the name of the list. For example, to store a value, chosen at random from the list `myStringList`, into the string variable `myString`, use the statement:

```
set myString to myStringList.random
```

Sorting the Values in a List

The values in a list can be sorted in three different ways using the `sortAscend`, `sortDescend`, and `shuffle` list attributes.

To sort the values in a list in ascending order (i.e., the first element contains the smallest value and the last element contains the greatest value), reference the list's `sortAscend` attribute:

```
listname.sortAscend
```

where *listname* is the name of the list to be sorted. This expression resolves to an integer value that is the total number of elements in the list.

Similarly, the list can be sorted in descending order (i.e., the first element contains the greatest value and the last element contains the smallest value) by referencing the list's `sortDescend` attribute:

```
listname.sortDescend
```

where *listname* is the name of the list to be sorted. Again, the expression returns an integer that represents the total number of elements in the list.

For example, consider the following Miniscript statements that refer to an integer variable, `myInt`, and an integer list, `myIntList`:

```
-- create a four-element list
set myIntList to {30, 40, 10, 20}
-- sort the list and return the number
-- of elements
set myInt to myIntList.sortDescend
```

After executing these statements, `myInt` contains the value 4, and `myIntList` contains the list `{40, 30, 20, 10}`.

Randomizing the Order of List Elements

List elements can be "unsorted" into a random order by referencing the list's `shuffle` attribute:

```
listname.shuffle
```

where *listname* is the name of the list to be shuffled. The expression returns an integer that represents the total number of elements in the list.

MEDIA CUE MESSENGER

The media cue messenger can be used to send messages at specified times when mToon, sound, or QuickTime media are playing. When activated, the media cue messenger monitors its element for a specified media cue point, such as the start or end of a range. When that point is reached, the messenger sends its message.

Components of the media cue messenger dialog (Figure 12.28) are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

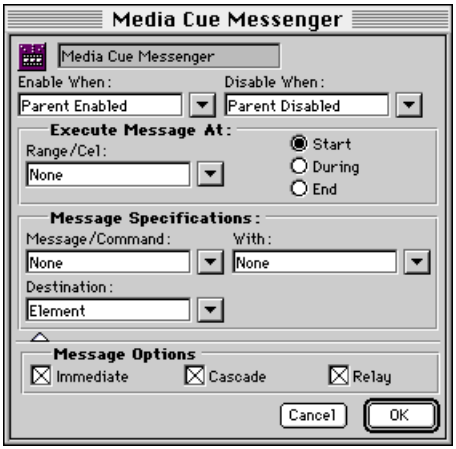


Figure 12.28 The Media Cue Messenger dialog

Enable When Pop-Up Menu

Use this pop-up menu to select the message that causes the media cue messenger to start checking the element for the media condition selected in the "Execute Message At:" section. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Disable When Pop-Up Menu

Use this pop-up to select the message that causes the media cue messenger to stop checking for the specified media condition.

"Execute Message At" Section

The controls in this section of the dialog specify the condition under which a message is sent.

Range/Time Pop-Up Menu

Use this pop-up to select a range that, when played, triggers a message. Valid entries are:

- **Named Toon Range**: If the media cue messenger is on an mToon that has named ranges defined, they appear in the "Toon Ranges" cascading menu item found in this pop-up menu.
- **Named Sound Marker**: If the media cue messenger is on a sound that has sound markers defined, they appear in the "Sound Markers" cascading menu item found in this pop-up menu. Note that sound markers are single points in a sound file, not ranges. Therefore, when selecting a sound marker as the "Range/Time" selection, use only the "Start" or "End" radio buttons. The

specified message is sent when the sound plays at the specified marker.

- **Integer Range or Integer Variable**: Any integer range variables in the media cue messenger's scope can be selected from the pop-up menu.

  If the media cue messenger is on an mToon, the integer range is interpreted as a range of cels in the mToon. If the messenger is on a QuickTime movie, the integer range is interpreted as a range of QuickTime timevalues (see "timevalue" on page 15.292).

  Alternatively, an integer variable can be selected to specify a single-cel "range". Note that if a single cel is specified, the "Start", "During", and "End" radio button selections all have the same effect.

- **Constant Range of Cels**: A literal integer range can be entered in the Range/Time field. Highlight the field and type an integer range in proper Miniscript syntax (e.g., `(2 thru 6)`). More information on the syntax for literal values can be found in "Literal Values" on page 14.260.

  If the media cue messenger is on an mToon, the integer range is interpreted as a range of cels in the mToon. If the messenger is on a QuickTime movie, the integer range is interpreted as a range of QuickTime timevalues (see "timevalue" on page 15.292).

  Alternatively, a single-cel "range" can be specified by entering an integer (e.g., `2`) in this field. Note that if a single cel is specified, the "Start", "During", and "End" radio button selections all have the same effect.

Start Radio Button

Select this radio button to send a message when:

- for mToons: the first cel in the range specified in the "Range/Time" field (i.e., the "start" value of the integer range) is played.
- for sounds: the specified sound marker is played.

During Radio Button

Select this radio button to send a message whenever an mToon cel within the specified range is played. This button has no effect when used with sound markers.

End Radio Button

Select this radio button to send a message when:

- for mToons: the last cel in the range specified in the "Range/Time" field (i.e., the cel that corresponds to the "end" value of the integer range) is played.
- for sounds: the specified sound marker is played.

Message Specifications

All messenger modifiers have the same controls in the Message Specification section of their dialogs:

Message/Command Pop-Up Menu

Use this pop-up to select the message or command to be sent when the messenger is activated. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

With Pop-Up Menu

Use this menu to select a value to be sent with the message or command. The choices on this pop-up are None, Incoming Data and any variables to which the element has access. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command.
- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its "scope." See "Variable Scopes" on page 13.253.
- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

Destination Pop-Up Menu

Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

All messenger dialogs have a Message Options section that can be revealed by clicking the triangle at the bottom of the dialog. Options in this section are:

Cascade Checkbox

When this box is checked, the message "cascades" from the targeted destination to all components in the hierarchy below it. Uncheck this option to configure the messenger to send its message only to the modifiers in a targeted element. "Cascade off" is equivalent to the path of an environment message sent by mTropolis.

- *Note: This option has no effect when sending a command.*

Immediate Checkbox

By default, messages or commands are sent immediately when the messenger is activated. Uncheck this box to configure the messenger to send its message or command only after the current thread of messages has ended. This option can be used to avoid system overload

if the message thread queue becomes too deep.

Relay Checkbox
By default, messages travel from element to element in the hierarchy activating any and all elements that respond to the message. Uncheck this box to activate only the *first* modifier in the path of the message that is configured to respond.

- *Note: This option has no effect when sending a command.*

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

MESSENGER

The messenger modifier (sometimes referred to as simply a "messenger") sends a message or command after it has received a specified message.

Components of the Messenger dialog are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Execute When Pop-Up Menu

Use this pop-up menu to select the message that causes the messenger to activate. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

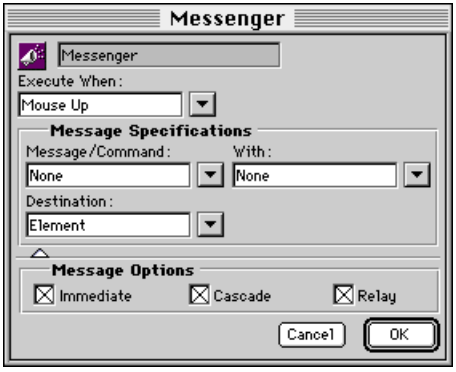


Figure 12.29 The Messenger dialog

Message Specifications

All messenger modifiers have the same controls in the Message Specification section of their dialogs:

Message/Command Pop-Up Menu

Use this pop-up to select the message or command to be sent when the messenger is activated. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

With Pop-Up Menu

Use this menu to select a value to be sent with the message or command. The choices on this pop-up are None, Incoming Data and any variables to which the element has access. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command.
- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its

"scope." See "Variable Scopes" on page 13.253.

- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

Destination Pop-Up Menu

Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

All messenger dialogs have a Message Options section that can be revealed by clicking the triangle at the bottom of the dialog. Options in this section are:

Cascade Checkbox

When this box is checked, the message "cascades" from the targeted destination to all components in the hierarchy below it. Uncheck this option to configure the messenger to send its message only to the modifiers in a targeted element. "Cascade off" is equivalent to the path of an environment message sent by mTropolis.

- *Note: This option has no effect when sending a command.*

Immediate Checkbox

By default, messages or commands are sent immediately when the messenger is activated. Uncheck this box to configure the messenger to send its message or command only after the current thread of messages has ended. This option can be used to avoid system overload if the message thread queue becomes too deep.

Relay Checkbox

By default, messages travel from element to element in the hierarchy activating any and all elements that respond to the message. Uncheck this box to activate only the *first* modifier in the path of the message that is configured to respond.

- *Note: This option has no effect when sending a command.*

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

MINISCRIPT MODIFIER

Miniscript is a simple scripting language embedded in a modifier. The Miniscript modifier allows you to use a scripting language to create customized modifiers that can:

- Get and set element attributes.
- Send messages and commands.
- Evaluate mathematical functions.
- Evaluate relational expressions and perform conditional branching.

A complete description of the Miniscript language can be found in Chapter 14, “Miniscript Modifier”.

Components of the Miniscript modifier dialog (Figure 12.30) are described below.

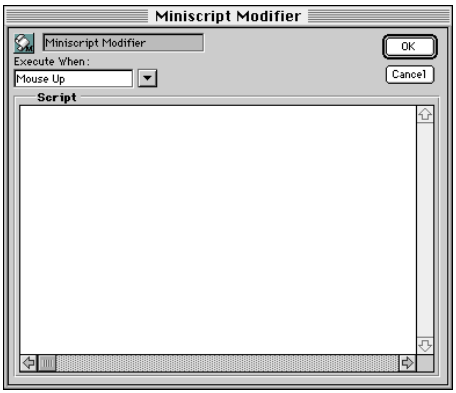


Figure 12.30 The Miniscript modifier dialog

Modifier’s Name Field
This editable text field can be used to change the modifier’s name.

Modifier Icon
This icon identifies the modifier’s type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that causes the Miniscript modifier to execute. For a complete discussion of this menu, see “When Pop-Up and Message/Command Pop-Up Options” on page 13.229.

Script Text Field
Enter the desired Miniscript script in this field. The syntax of the script is checked when the OK button is clicked. A complete description of the Miniscript language can be found in Chapter 14, “Miniscript Modifier”.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

NAVIGATION MODIFIER

The navigation modifier executes a scene change when triggered in runtime mode. Any scene in any section and subsection of the project can be selected by name or by certain "relative" criteria. Note that this modifier is a "superset" of the functionality provided by the change scene modifier (described on page 12.136).

Components of the navigation modifier dialog (Figure 12.31) are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

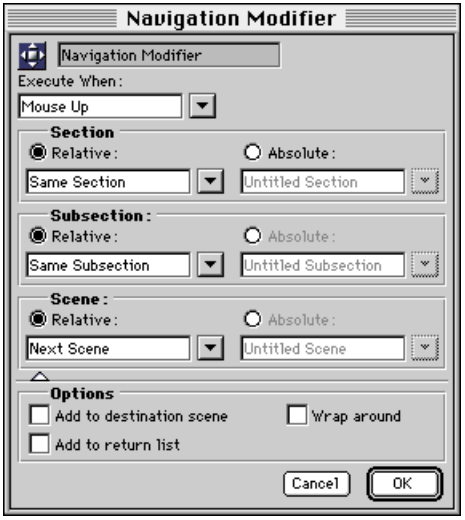


Figure 12.31 The Navigation Modifier dialog

Execute When Pop-Up Menu

Use this pop-up menu to select the message that causes the scene to change. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Section Options

Use the controls in this section of the dialog to select the section that contains the scene to be changed to. Options include:

- **Relative Radio Button**: Select this button to activate the Relative pop-up menu. This menu can be used to select a section by its position relative to the current section. Select from "Same Section", "Previous Section", "Next Section", "First Section", and "Last Section". Note that the order of sections can be changed in the structure window. See "Changing the Order of Components in the Structure Window" on page 8.86.
- **Absolute Radio Button**: Select this button to activate the Absolute pop-up menu. This menu can be used to select a section by name.

Subsection Options

Use the controls in this section of the dialog to select the subsection that contains the scene to be changed to. Options include:

- **Relative Radio Button**: Select this button to activate the Relative pop-up menu. This menu can be used to select a subsection by its position relative to the current subsection. Select from "Same Subsection", "Previous Subsection", "Next Subsection",

"First Subsection", and "Last Subsection". The "Corresponding Subsection (by Index)" can be selected to designate the subsection in the new section that has the same position in the subsection order as the current subsection. The "Corresponding Subsection (by Name)" option can be selected to designate the subsection in the new section that has the same name as the current subsection. Note that the order of subsections can be changed in the structure window. See "Changing the Order of Components in the Structure Window" on page 8.86.

- **Absolute Radio Button**: Select this button to activate the Absolute pop-up menu. This menu can be used to select a subsection by name. This option is available only if the Section has also been specified by name (i.e., the Section option's Absolute radio button is also selected).

Scene Options

Use the controls in this section of the dialog to select the scene to be changed to. Options include:

- **Relative Radio Button**: Select this button to activate the Relative pop-up menu. This menu can be used to select a scene by its position relative to the current scene. Select from "Same Scene", "Previous Scene", "Next Scene", "First Scene", and "Last Scene". The "Corresponding Scene (by Index)" can be selected to designate the scene in the new subsection that has the same position in the scene order as the current scene. The "Corresponding Scene (by Name)" option can be selected to designate the scene in the new subsection that has the same name as the current scene. Note that the order of scenes can be changed in the structure window. See "Changing the Order of Components in the Structure Window" on page 8.86.

- **Absolute Radio Button**: Select this button to activate the Absolute pop-up menu. This menu can be used to select a scene by name. This option is available only if the Subsection has also been specified by name (i.e., the Subsection option's Absolute radio button is also selected).

Options Check Boxes

Click the open/close triangle at the bottom of the Navigation Modifier dialog to reveal navigation options:

- **Add to Destination Scene**: Select this checkbox to perform a special scene change in which the currently displayed scene is still visible after the change to the new scene. That is, the current scene acts like a shared scene for this scene change. Note that selecting this option automatically selects the "Add to Return List" option as well.

  When this option is checked and a scene change is triggered, the Scene Deactivated message is sent to the "original" scene. See "Scene Deactivated" on page 13.244. If the return modifier is used to return from the new scene to the original scene, the Scene Reactivated message is sent to the original

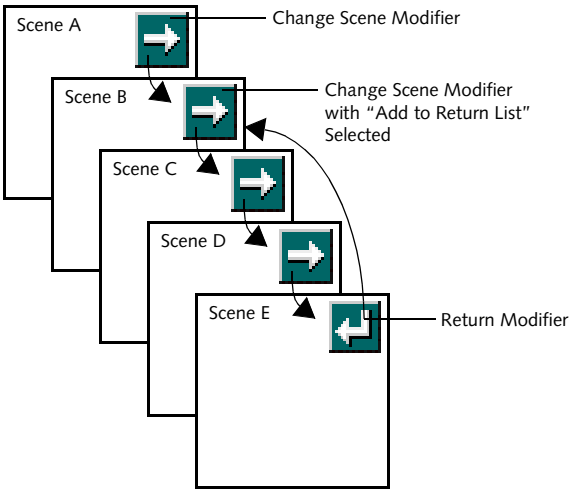


Figure 12.32 The Return List

scene. See "Scene Reactivated" on page 13.244.

Hot Tip

The "Add to Destination Scene" option can be used to simulate dialog boxes and alerts. Put elements and artwork that comprise the dialog or alert on the destination scene and ensure that this option is checked. When the scene is changed to, it looks as though the dialog has appeared "in front" of the previous scene. The return modifier can be used to "dismiss" the dialog or alert.

- **Add to Return List**: Select this checkbox to make the current scene the one returned to by the next return modifier in a series of scenes. For example, in Figure 12.32, change scene modifiers have been placed on each of the scenes. Each of these modifiers has been configured to change to the next scene. Scene B's scene change modifier has the Add to Return List option selected. A return modifier has been placed on Scene E. When this modifier receives the message that will activate it during runtime, Scene E will change to Scene B (the arrows show the sequence of scenes).

- **Wrap Around**: By default, the first and last scene in a subsection have no connection in the scene order. That is, the last scene in a subsection has no next scene and the first scene in a subsection has no previous scene.

  When this checkbox is selected, a change to the "Next Scene", executed from the last scene in a subsection, "wraps around" the list of scenes and changes to the first scene in the subsection.

  Similarly, a change to the "Previous Scene", executed from the first scene in a subsection, "wraps around" the list of scenes and changes to the last scene in the subsection.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

OBJECT REFERENCE VARIABLE

The object reference variable stores a reference to another mTropolis object. It acts as a "pointer" to another mTropolis component.

The object reference variable can be configured to store an initial value. It can also be configured to update its reference automatically upon receipt of a message. When the specified message is received, the object reference variable stores a reference to the parent of the messenger that sent the activating message (i.e., it stores the value of `source's parent`).

Once a value is stored, the referenced component can be targeted as the recipient for messages sent from Miniscript or used in other operations where a value of object reference type can be used. See "Miniscript Syntax for Object Reference Variables" on page 12.180.

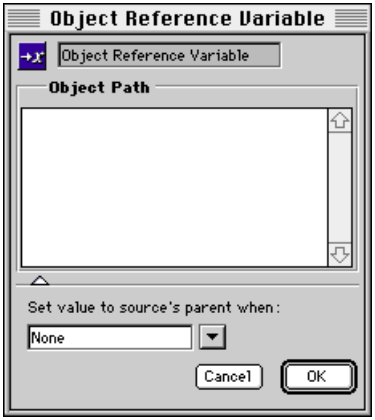


Figure 12.33 The Object Reference Variable dialog

Object reference variables have another useful property: they can be used to reference components even if that component has been unloaded from memory (i.e., the referenced component resides on a scene that has been unloaded from memory). Whenever the object reference variable is referred to, the component it stores a reference to is reloaded.

Components of the object reference variable dialog (Figure 12.33) are described below.

Variable's Name Field

This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon

This icon identifies the variable modifier's type.

Object Path Field

This field can be used to set an initial value for the object reference variable. This field is also updated whenever the value stored in the object reference variable changes. This field specifies the "path" to an object in a mTropolis project using the syntax described below:

- The path is described using a syntax similar to that used to specify directory names in Unix. The full path to an object, starting from the project level would be:

  ```
  /project/subsection/section/scene/
  element
  ```

  where *project* is the actual name of the project, *subsection* is the name of the

subsection, etc., all the way to *element* which is the name of the specific element being referenced.

- As implied above, the slash character (/) separates levels in the mTropolis structure hierarchy.
- To reference objects by their position relative to the object reference variable, a relative pathname can be used. To specify structure levels *above* the current position, use "`..`" to move up a level and "`/`" to separate levels. For example, if the object reference variable is in an element whose parent is the scene, the path:

  ```
  ../../myelement
  ```

  would cause "myelement" to be searched for at the scene level.

  Similarly, to refer to a modifier that is a sibling of the object reference variable, a path such as:

  ```
  ../mymodifier
  ```

  would cause the modifier named "mymodifier" to be searched for within the variable's parent element.
- A special token, `<project>`, can be used to refer to the project component instead of the project's actual name. Using `<project>` prevents the object reference path from becoming invalid if the name of the project is changed (i.e., if the project is saved with a different filename). For example, an object might be specified by:

  ```
  /<project>/mysection/mysubsection/
  myscene/myelement
  ```

The syntax for the object path field is checked when the OK button is clicked. If the syntax is not in the correct format, an error alert appears. Note that, while the syntax is checked, the actual existence of the object specified in this field is *not* checked. The value of this field is not resolved to an object reference until the variable is referenced in runtime mode.

Set Path to Source's Parent When Pop-Up Menu

Click the open/close triangle at the bottom of the object reference dialog to reveal the "Set path to source's parent when:" pop-up menu. Use this menu to select a message that causes the value of the variable to change to the parent of the messenger that sent the activating message.

- *Note: As mTropolis has no "parent," environment messages originating from mTropolis cannot be used to set the value of this variable. For example, suppose "Mouse Up" is selected in the "Set Value to Source's Parent" menu. A user mouse click that generates a Mouse Up message will not cause the value of this variable to change. However, a "Mouse Up" message sent by a messenger modifier would trigger the value change.*

For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Differences between Specifying an Object Path versus the Set Path to Source's Parent Pop-Up

When a path is entered into the Object Path Field, the path is not resolved to an object reference until the object reference variable is accessed during runtime. If the specified object is moved before the variable is referenced, the path will not be resolvable. However, if the object reference is established by the message specified in the "Set path to source's parent pop-up", the reference will always be current, even if the object moves.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

MINISCRIPT SYNTAX FOR OBJECT REFERENCE VARIABLES

The value contained by an object reference variable can be accessed through Miniscript as described below. A general overview of Miniscript can be found in Chapter 14, "Miniscript Modifier".

Sending Messages to the Referenced Object

The component referenced by the object reference variable can be accessed as the "object" attribute of the object reference variable. That is, to send a message to the object at which the object reference variable is pointing, use the following syntax:

```
send "message" to objectvar.object
```

where *message* is the message or command to be sent and *objectvar* is the name of the object reference variable being accessed. For example, to send the *Play* command to the object referenced by an object reference variable named "pointer1", use the statement:

```
send "Play" to pointer1.object
```

Why is the "Object" Attribute Necessary?

New users of the object reference variable are sometimes confused by the need for the "object" attribute. The "object" attribute is necessary because both the object stored in the variable, and the object reference variable *itself* are valid targets for mTropolis messages and Miniscript expressions.

Consider the following Miniscript statement:

```
send "Set Me" to myObjectRef
```

where "Set Me" is an author message and "myObjectRef" is the name of an object reference variable. This command sends the "Set Me" message *directly to the object reference variable*, because the variable is a valid destination for the message. For example, "Set Me" may be the message that triggers a change in the object reference variable's value. The message is *not* passed on to the object referred to by the variable.

The statement:

```
send "Set Me" to myObjectRef.object
```

sends the "Set Me" message to the component referred to by myObjectRef, where it might have a completely different effect.

Changing the Value of an Object Reference Variable

To change the reference held by an object reference variable, use the following syntax:

set *objectvar* **to** *object*

where *objectvar* is the name of the object reference variable being accessed and *object* is a mTropolis object specified by name, by relative position (see Table 14.2 on page 14.265 for a list of "building blocks" that can be used to specify elements), or by the "object path field" syntax. A number of examples follow:

```
-- point to the parent of the element
-- that contains the variable:
set myObjectRef to element.parent

-- point to the scene:
set myObjectRef to scene

-- point to the message source's
-- parent:
set myObjectRef to source's parent

-- point to the message source's
-- element:
set myObjectRef to source's element

-- point to an element by name:
set myObjectRef to myBigBlueButton

-- change the value using a string
-- that contains a path specification:
set myObjectRef to \
  "/myProj/mySect/mySub/Scene/Bob"

-- The variable's "path" attribute
-- could also be used to set the value
-- using a string:
set myObjectRef.path to \
  "/myProj/mySect/mySub/Scene/Bob"

-- The path could also be set using
-- a string variable instead of a
-- string constant. In this case,
-- the "path" attribute must be used:
set myObjectRef.path to myString
```

Clearing the Value of the Object Reference Variable

The object reference variable can be "reset" so that it no longer refers to an object by setting its value to the special value **none**. For example:

```
set myObjectRef to none
```

Alternatively, the "path" attribute of the object reference variable can be set to a null string. For example:

```
set myObjectRef.path to ""
```

Detecting an Empty Object Reference Variable

An object reference variable that does not refer to an object or refers to an invalid object (i.e., an object that does not exist) has the value **none**. In addition, its "fullpath" attribute contains a null string.

For example, suppose myObjectRef has been configured to point to an element that does not exist. The following script could be used to send a message based on this fact:

```
if myObjectRef = none then \
   send "Invalid Reference"
```

Alternatively, the "fullpath" attribute can be examined:

```
if myObjectRef.fullpath = "" then \
   send "Invalid Reference"
```

Accessing Attributes of the Referenced Object

Any attributes of the object pointed to by the object reference variable can be targeted using the syntax:

objectvar.object.*attribute*

where *objectvar* is the name of the object reference variable and *attribute* is the name of an attribute of the referenced object. See Chapter 15, "Attributes" for more information on attributes.

For example, the width of the referenced object can be retrieved:

```
set myInt to myObjectRef.object.width
```

Similarly, the attributes of a referenced object can be changed. For example:

```
set myObjectRef.object.position \
    to (40, 50)
```

Attributes of the Object Reference Variable

The object reference variable has a number of attributes that can be accessed via Miniscript. For general information about using attributes, see Chapter 15, "Attributes". The table below describes attributes for the object reference variable in a format similar to that found in "Attribute Descriptions" on page 15.276:

Attribute	Type	R	W	Description
path	string	•	•	The path to the object as specified in the Object Path field. Changing this attribute changes the value stored within the object reference variable.
fullpath	string	•		The absolute, resolved path to the referenced object.
object	varies	•	•	The referenced object. The type varies depending upon what is being referenced.

OPEN PROJECT MODIFIER

The open project modifier can be used to open a different project or title file during runtime. The currently-running title project or title is closed, while the newly-opened project or title starts running from its beginning.

In the mTropolis editor, this modifier can be used to open both project files (i.e., the editor's file format) and built title files (i.e., finished mTropolis titles created with the **File-Build Title** option). However, in a built title being run with a mTropolis player application, this modifier can only open other built title files. Typically this modifier would be used to open other *project* files during the development stage of a project. However, when it comes time to distribute a built title that contains this modifier, the modifier's "Project/Title Path" field must be updated to refer to the *built title* version of the project that needs to be opened.

- *Note: Because this modifier closes the current project, any project that this modifier is added to must be saved (select* **Save** *or* **Save As** *from the File menu) before switching to runtime mode for testing.*

Components of the open project modifier dialog (Figure 12.34) are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Execute When Pop-Up Menu

Use this pop-up menu to select the message that causes the specified project/title to be opened and the current one to be closed. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to specify the project or title file to be opened.

Project/Title Path Field

Use this field to specify the full path to the project or title file to open. Enter a path as described below, or click the "Choose" button to select a project or title file using a standard file dialog.

Paths specified in this way are not resolved until runtime, so a file that does not currently exist can be specified. Note also that the full

Figure 12.34 The Open Project Modifier dialog

path name is limited to a maximum of 255 characters.

- **Entering the Text of an Absolute or Relative Path**: Enter an absolute or relative path to a mTropolis project or title file in this field. This path must be specified using the standard colon-delimited Macintosh path syntax.

  An absolute path can be specified by starting with the name of the hard disk volume and continuing down through the disk hierarchy. For example:

  ```
  My HD:My Folder:My mTitle
  ```

  A path relative to the location of the currently running project or title can be specified by using colons to move up the filesystem hierarchy. For example, to indicate a project in the same folder as the currently running project, use the syntax:

  ```
  :My mProject
  ```

  To indicate a file in the next folder or volume up the hierarchy, use the syntax:

  ```
  ::My mProject
  ```

  Similarly, any number of colons can be used to move up to the desired level of the filesystem hierarchy. Once the desired level has been specified, folders down from that location can be specified. For example, to specify a project named "My Project" found within a folder named "Projects" which is three folders up from the currently-running project, use the syntax:

  ```
  :::Projects:My Project
  ```

  There is one special "token" that can be used in the Project/Title Path field. The token "<Startup Segment Folder>" can be used to specify the folder that contains the currently-running title. For example, the following file specification would open the mTropolis title named "Title2", found in the currently-running project's startup segment folder:

  ```
  <Startup Segment Folder>:Title2
  ```

Choose Button
Select this button to display a standard file selection dialog. Choose the project or title file to be opened. Once selected, the absolute path to the selected file appears in the Project/Title Path field.

"Add to return list" Checkbox
When this option is checked, the project that contains this modifier is added to the "return list". The project can be returned to by executing a return modifier in the newly-opened project. See Figure 12.11 on page 12.137 for a graphical description of the return list.

If this option is selected, the project will also be returned to when the newly-opened project closes in response to the *Close Project* command. See "Close Project (Message/ Command Menu Only)" on page 13.246.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

Open Project Attributes

The open project modifier has a number of attributes that can be accessed via Miniscript. For general information about using attributes, see Chapter 15, “Attributes”. The table below describes attributes for the open project modifier in a format similar to that found in “Lists of Attributes by Component Type” on page 15.295.

Open Project Modifier Attribute	Type	R	W	Description
path	string	•	•	The contents of the Project/Title Path field.
addToReturnList	bool	•	•	The setting of the “Add to return list” checkbox. This attribute is true if the box is checked.

Table 12.1: Attributes of the Open Project Modifier

PANORAMA MESSENGER MODIFIER

The panorama messenger modifier sends a message or command in response to user mouse messages on hotspots or other navigation events within a QuickTime VR panorama movie. This modifier only takes effect when attached to a QuickTime VR panorama movie.

Components of the Panorama Messenger dialog (Figure 12.35) are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Figure 12.35 The Panorama Messenger dialog

Execute When Pop-Up Menu

Use this pop-up menu to select the message that causes the messenger to activate. This menu has a different set of options than the standard When Pop-Up menu. Note also that these messages are only generated by user mouse actions over panoramic movies; they cannot be sent to panoramic movies by the author. Options include:

- **None**: When this option is selected, the modifier will never be executed.
- **Hotspot Mouse Down**: Select this option to execute the messenger when the mouse button is pressed down and the mouse cursor is over a hotspot in the panorama movie. The "Hotspot" section of the dialog can be used to select the hotspot that listens for this message. This message arrives with the object ID (an integer) of the clicked hotspot as incoming data.
- **Hotspot Mouse Up**: Select this option to execute the messenger when the mouse button is pressed down over a hotspot and then released anywhere. The "Hotspot" section of the dialog can be used to select the hotspot that listens for this message. This message arrives with the object ID (an integer) of the clicked hotspot as incoming data.
- **Hotspot Mouse Over**: Select this option to execute the messenger when the mouse passes into a hotspot region. The "Hotspot" section of the dialog can be used to select the hotspot that listens for this message. This message arrives with the object ID (an

integer) of the moused-over hotspot as incoming data.

- **Hotspot Mouse Outside**: Select this option to execute the messenger when the mouse leaves (passes out of) a hotspot region. The "Hotspot" section of the dialog can be used to select the hotspot that listens for this message. This message arrives with the object ID (an integer) of the moused-over hotspot as incoming data.
- **Panning**: Select this option to execute the messenger when the panorama is being panned. The panning message is sent continuously (one message each time the screen updates) until panning stops. This message arrives with the new pan angle (a floating-point value representing 0 to 360 degrees) as incoming data.
- **Zooming**: Select this option to execute the messenger when the panorama is being zoomed (i.e., when the field of view is changing). The zooming message is sent continuously (one message each time the screen updates) until zooming stops. This message arrives with the new zoom angle (a floating point value representing field of view representing 0 to 90 degrees) as incoming data.
- **Leaving Node**: Select this option to execute the messenger when the user navigates from one node in the QuickTime VR movie to another. This option only has effect when used with multi-node QuickTime VR movies (sometimes called *scenes* in Apple's QuickTime VR documentation). This message arrives with the object ID (an integer) of the node to which the user is navigating as incoming data.

Hotspot Section

Use the controls in this section to specify a hotspot when the modifier is configured to execute on a hotspot message such as Hotspot Mouse Down.

All Radio Button

Select this button to listen for hotspot messages generated by any hotspot in the movie.

By Name Radio Button and Pop-Up Menu

Select this button to listen for hotspot messages generated only by the hotspot named in the accompanying pop-up menu. Any named hotspots in the movie appear in the pop-up menu.

By ID Radio Button and Field

Select this button to listen for hotspot messages generated only by the hotspot with the ID number selected in the accompanying field. Each hotspot in a movie has a unique ID number with a value between 1 and 255. To use this feature, you must make note of which hotspots map to which ID numbers when creating hotspots in your QuickTime VR movie.

Node Checkbox and Field

Select this checkbox to specify in which node the hotspot specified in the "By Name:" or "By ID" section is found. Leaving this box unchecked (the default) causes the messenger to listen for hotspot messages from all

hotspots (with the specified name or ID) across all nodes.

Message Specifications

All messenger modifiers have the same controls in the Message Specification section of their dialogs:

Message/Command Pop-Up Menu

Use this pop-up to select the message or command to be sent when the messenger is activated. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

With Pop-Up Menu

Use this menu to select a value to be sent with the message or command. The choices on this pop-up are None, Incoming Data and any variables to which the element has access. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command. Incoming data values for each of the special panorama messages are described in the "Execute When Pop-Up Menu" section, above.
- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its "scope." See "Variable Scopes" on page 13.253.
- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

Destination Pop-Up Menu

Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

All messenger dialogs have a Message Options section that can be revealed by clicking the triangle at the bottom of the dialog. Options in this section are:

Cascade Checkbox

When this box is checked, the message "cascades" from the targeted destination to all components in the hierarchy below it. Uncheck this option to configure the messenger to send its message only to the modifiers in a targeted element. "Cascade off" is equivalent to the path of an environment message sent by mTropolis.

- *Note: This option has no effect when sending a command.*

Immediate Checkbox
By default, messages or commands are sent immediately when the messenger is activated. Uncheck this box to configure the messenger to send its message or command only after the current thread of messages has ended. This option can be used to avoid system overload if the message thread queue becomes too deep.

Relay Checkbox
By default, messages travel from element to element in the hierarchy activating any and all elements that respond to the message. Uncheck this box to activate only the *first* modifier in the path of the message that is configured to respond.

- *Note: This option has no effect when sending a command.*

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

PANORAMA NAVIGATION MODIFIER

The panorama navigation modifier can be used to control the display of QuickTime VR panorama movies. Upon receipt of a message, the modifier changes the view shown in the movie from the currently-displayed location to a named location in the movie or a location specified by node, pan, tilt, and field of view parameters. This modifier only takes effect when attached to a QuickTime VR panorama movie.

Components of the Panorama Navigation Modifier (Figure 12.36) dialog are described below.

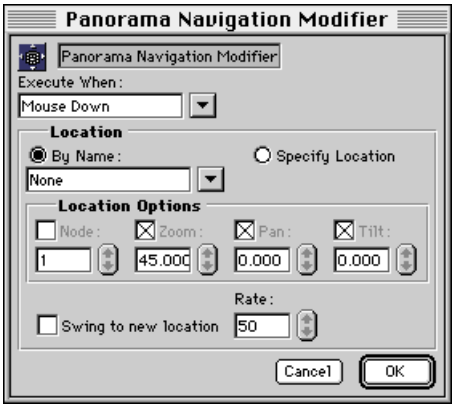


Figure 12.36 The Panorama Navigation Modifier dialog

Execute When Pop-Up Menu

Use this pop-up menu to select the message that causes the panorama navigation modifier to execute. Upon the receipt of this message, the QuickTime VR movie updates to show the view defined in the Location section of the Panorama Navigation Modifier dialog. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

- *Note: Because user mouse events are used to navigate QuickTime VR movies, it is not usually possible to execute this modifier based on mouse events such as "Mouse Up". To make a QuickTime VR panorama unresponsive to user mouse events and instead pass those events to mTropolis, use the movieClick attribute, described on page 15.287.*

Location Section

Use the controls in this section to specify the new view shown in the QuickTime VR movie.

By Name Radio Button and Pop-Up Menu

Select this button (the default) to specify a new location by name. The pop-up menu displays a list of all locations defined in the movie. Locations can be defined and named using the "Panorama Location Namer" utility, found in the QuickTime Utilities folder of the mTropolis distribution.

Specify Location Radio Button

Select this button to specify a new location using QuickTime VR parameters. The Location Options checkboxes become enabled:

- **Node Checkbox and Field**: Select this checkbox (checked by default) to specify the node to be displayed. If this box is not selected, the current node is used.
- **Pan Checkbox and Field**: Select this checkbox (checked by default) to specify the pan angle to be displayed. This value is a floating-point number representing degrees from 0 to 360. If this box is not checked, the current panning is used.
- **Tilt Checkbox and Field**: Select this checkbox (checked by default) to specify the tilt angle to be displayed. This value is a floating-point number representing degrees from -90 to 90. If this box is not checked, the current tilt is used.
- **Field of View Checkbox and Field**: Select this checkbox (checked by default) to specify the field of view to be displayed. This value is a floating-point number representing degrees from 0 to 90 (0 is fully zoomed in, 90 is fully zoomed out).

Swing to New Location Checkbox

Select this checkbox (unchecked by default) to make the view "swing" (i.e., animate) to its new location. If this box is unchecked, the view changes instantly to the new settings. When this box is checked, the Rate field also becomes enabled.

Rate Field

Use this field to specify the speed of the "swing" animation as the QuickTime VR view changes to its new settings. Valid values range from 1 (slowest) to 100 (fastest). The default is 50. The speed of the actual transition may vary depending upon the speed of the target machine.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

PATH MOTION MODIFIER

The path motion modifier can be used to add motion along a path to an element. Any child elements of the element that contains the path motion modifier also move along the path.

This modifier is especially useful when used with mToons. It can be used to specify which cels are visible at each point along the path. Multiple path motion modifiers can be used to define many paths for a single animation. Each of these modifiers can be configured to respond to different messages, allowing the element to move on a specific path according to specific conditions.

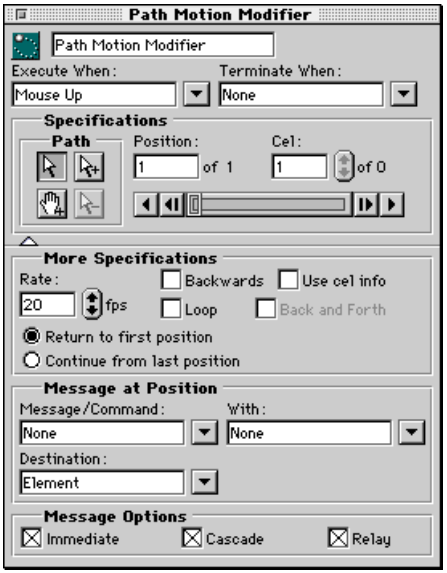


Figure 12.37 The Path Motion Modifier dialog

The motion path is stored in the modifier itself. Once a path is defined, it can be used again by dragging a copy onto another Graphic element, movie or mToon.

In addition to defining motion paths, this modifier can be used to send messages from any point along the motion path.

Components of the path motion modifier dialog (Figure 12.37) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that enables the path motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Terminate When Pop-Up Menu
Use this pop-up menu to select the message that stops the path motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

The controls in this section allow you to create the motion path and specify animation cels for individual positions.

Path Tools

Selection Arrow: The selection arrow allows you to move any position on the motion path. When a position is selected, the modifier's associated element will automatically move to that position on the path.

Add Position Tool: Use this tool to define a new position on the path. Clicking on the scene after the last selected point adds a position to the path.

To add a position between two points on an existing path, select the first of the two points with the Selection Arrow, and click on the scene before the next point. (If the Option key is depressed while the add position tool is selected, the select arrow appears, allowing a point to be selected and/or moved.)

Drag Path Tool: This tool allows you to Mouse Down and drag an element on its scene to define a motion path. When the mouse is released the points of the modifier's path are automatically drawn. (If the Option key is depressed while the drag path tool is selected, the select arrow appears, allowing a point to be selected and/or moved.)

Delete Position Tool: This tool allows you to select and delete positions anywhere along the motion path. (If the Option key is depressed while the delete position tool is selected, the select arrow appears, allowing a point to be selected and/or moved.)

Position Field

This field shows the number of the position currently being edited of the total positions on the path. The step controls below this field allow you to step forward or back through the positions of the motion path one at a time.

The Position and Cel fields work together, allowing the author to assign a specific cel of an animation to a selected position on the motion path.

Cel Field

This field shows the number of the current cel and the total number of cels in the animation. Use the arrow controls to scroll through the cels of the animation. Each point on the motion path can have a different cel associated with it.

Animation Controller Bar

These basic controls allow you to step, or play through the positions forward or backward. The arrows to the right and left allow you to preview the motion path forward and backwards while the dialog is open.

To use this feature, the compression method used to compress the animation must allow cels to be randomly accessible.See "Compression" on page 2.29.

More Specifications Section

Click the white triangle at the bottom of the path motion dialog to toggle the display of more options for path animations:

Rate Field
Select the rate, in frames per second, at which the animation will be played over the path. This setting overrides any previous rate setting in the element's Element Info dialog.

Return to First Position Radio Button
Select this option to reset the element to its original starting position whenever the path motion restarts or is looped.

Continue from Last Position Radio Button
Select this option to continue path motion from the last position of the path whenever path motion restarts or is looped.

Backwards Checkbox
Select this box to play through the motion positions from the last position to the first position.

Use Cel Info
Select this box to use the cel positions defined with the "Cel" field in the dialog's Specifications section.

When unselected, cels will be mapped sequentially to each position. If the number of cels is less than the number of positions on the path, the animation sequence will loop. If the number of cels is greater than the number of positions on the path, the number of cels displayed will be divided among the number of defined positions.

Loop Checkbox
Select this box to make the path motion loop. That is, the element moves along the motion path continuously from beginning to end positions.

Back & Forth Checkbox
Select this option to play the path motion from start to end, then backward from end to start.

Message at Position Section

Use the controls in this section to select a message to be sent when the element is at the current position in the motion path (i.e., the position shown in the "Position" field of the Path Motion Modifier dialog). A different message can be selected for each point in the motion path. The default is to send no message.

Message/Command Pop-Up Menu
Use this pop-up to select the message or command to be sent when the current path motion point is reached. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

With Pop-Up Menu
Use this menu to select a value to be sent with the message or command. The choices on this pop-up are None, Incoming Data and any variables to which the element has access. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command.

- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its "scope." See "Variable Scopes" on page 13.253.
- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

Destination Pop-Up Menu

Use this menu to select the destination for the message or command sent from this modifier. For a complete discussion of this menu, see"The Destination Pop-Up Menu" on page 13.249.

Message Options

The standard message options are available for controlling the behavior of the selected message. See "Message Options" on page 12.128 or "Message Options" on page 12.172 for a complete description of the controls in this section.

POINT VARIABLE

The point variable modifier stores a pair of integer values, commonly used for storing and/or setting the screen location of elements. For example, the position of an element can be changed during runtime by placing multiple point variables on the element with different values in each. New positions can then be set using the Miniscript modifier.

Note that the location of an element is measured in pixels relative to its parent's origin (the upper left corner of the parent).

Components of the point variable dialog (Figure 12.38) are described below:

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Fields
Enter the variable's initial value here or use the up/down arrow buttons to set the value. There are two fields:

- X: The horizontal value.
- Y: The vertical value.

The value is checked for validity when the OK button is clicked. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

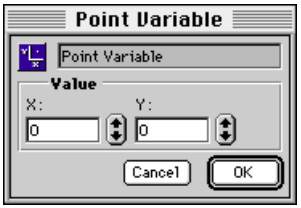


Figure 12.38 The Point Variable dialog

RETURN MODIFIER

Upon receipt of a specified message, the return modifier executes a scene change to the first scene in the "scene return list". See Figure 12.11 on page 12.137 for a graphical explanation of the return list. Note that once a scene has been returned to, it is removed from the return list and the next scene in the list (if any) becomes the next scene to be returned to.

Components of the return modifier dialog (Figure 12.39) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that triggers the scene return. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

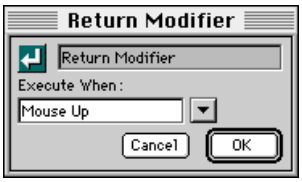


Figure 12.39 The Return Modifier dialog

SAVE AND RESTORE MODIFIER

The save and restore modifier can be used to save data stored in a mTropolis variable to a file and restore that data upon receipt of specified messages. Any previously created mTropolis variable of any type (including user-defined compound variables) can be saved and restored. This sort of functionality is essential for game titles that are designed to be played over multiple sessions. Using an elaborate compound variable (see "Compound Variable" on page 12.144) with this modifier allows the author to save and restore complicated states.

The file can be saved to a number of preset locations or the user can be prompted to select a location for the file.

Components of the save and restore modifier dialog (Figure 12.40) are described below.

Modifier's Name Field
This editable text field can be used to change the modifier's name.

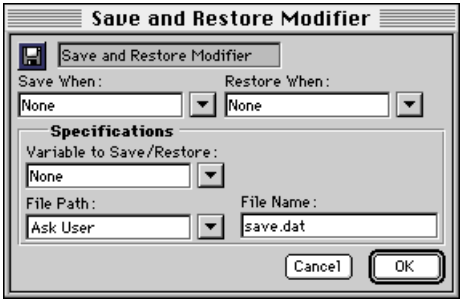


Figure 12.40 The Save and Restore Modifier dialog.

Modifier Icon
This icon identifies the modifier's type.

Save When Pop-Up Menu
Use this menu to select the message that causes the selected variable to be saved. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Restore When Pop-Up Menu
Use this menu to select the message that causes the selected variable to be restored (i.e., read from the previously saved file). The specified mTropolis variable is set to the values contained in the save file. Note that if a "restore" operation is attempted before a "save" operation has been performed (i.e., a file with the specified name and location does not yet exist), the current value of the specified variable is not changed. For a complete discussion of the options in this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Data to Save/Restore Pop-Up Menu
Use this pop-up menu to select the data to be saved and/or restored. When saving, the selected data is written to the specified file. If the modifier is configured to restore, this field must be used to select a variable. The data saved in the specified file is restored into the specified variable. Selections are described in more detail below:

- **None**: This is the default selection. No data can be saved or restored.
- **Incoming Data**: Choose this option to configure the modifier to save the incoming

data (i.e., the value that arrives with the message that has been configured to trigger the messenger), to the specified file. This selection cannot be used to restore data.

- **Variables**: Select the name of a variable from the submenus available in the second section of this pop-up menu. When the modifier is triggered to save, the value contained within a selected variable is written to the specified file. When the modifier is triggered to restore, data from the specified file is placed in the selected variable. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. See "Variable Scopes" on page 13.253.
- **Constant Data Value**: Though a constant data value can be entered into this field, constants cannot be saved to files nor can data be restored into a constant. Using the field in this way is the equivalent of selecting "None".

File Path Pop-Up Menu

Use this pop-up to select the location in which the file (specified in the "File Name:" pop-up) will be saved. Options are:

- **<Preferences Folder on Macintosh>**: Select this option to save or restore the data file in the Macintosh "Preferences" folder, found in the Macintosh "System Folder". This option is ignored, and replaced with the "Ask User" option when the title is built for Windows platforms.
- **<Startup Segment Folder>**: Select this option to save or restore the data file in the same location as the application's startup segment. See "Build Title" on page 2.39 for more information about startup segments and built titles.
- **Ask User**: Select this option to display a file selection dialog in which the user selects the path and file to be written to or loaded from. The filename specified in the "File Name" field becomes the "default" filename that the user can change.
- **Text of Absolute or Relative Path**: To enter an absolute or relative path to a folder, highlight the text of this field and enter a path. This path must be specified using the standard colon-delimited Macintosh path syntax.

  An absolute path can be specified by starting with the name of the hard disk volume and continuing down through the disk hierarchy. For example:

  ```
  My HD:My Folder:My Subfolder
  ```

  A path relative to the location of the startup segment can be specified by using colons to move up the filesystem hierarchy. For example, to indicate a folder in the same folder as the startup segment, use the syntax:

  ```
  :My Folder
  ```

  To indicate a folder in the next folder/volume up the hierarchy, use the syntax:

  ```
  ::My Folder
  ```

  Similarly, any number of colons can be used to move up to the desired level of the

filesystem hierarchy. Once the desired level has been specified, folders down from that location can be specified. For example, to specify a folder named "Scores" found within a folder named "Data" which is three folders up from the startup segment, use the syntax:

```
:::Data:Scores
```

Note that paths specified this way are not resolved until runtime, so a folder that does not currently exist can be specified.

File Name Field
Use this field to specify the name of the file to be saved in the location selected in the "File Path" pop-up. The default name is **save.dat**.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SCENE TRANSITION MODIFIER

The scene transition modifier adds a special transition effect to a scene. Transition effects are often desired when changing from one scene to the next. The transition pop-up lists options, such as dissolve, slide, push, etc. The transition becomes visible only on the next scene change. Note that time-based media (e.g., video, mToon, or sound elements) in the new scene do not begin playing until the transition effect has finished.

Components of the scene transition modifier dialog (Figure 12.41) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

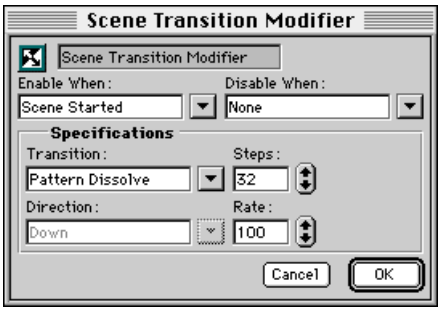


Figure 12.41 The Scene Transition modifier

Enable When Pop-Up Menu
Use this pop-up menu to select the message that enables the scene transition. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

This modifier is commonly activated on a Scene Started message. However, other messages could be chosen to activate a transition. For example, when a user clicks an element to turn right, a push right could be enabled, while when clicking an element to turn left, a push left could be enabled.

Disable When Pop-Up Menu
Use this pop-up menu to select the message that disables the scene transition. Note, however, that a transition cannot be disabled while it is being played.

Specifications Section

Use the controls in this section to select the type of transition.

Transition Pop-Up Menu
This pop-up contains a list of all available transition types. Options include:

- Pattern Dissolve
- Random Dissolve
- Fade
- Push
- Slide
- Wipe
- Zoom

Steps Field
Use this field to specify the number of steps between the start and finish of the transition. The greater this number, the finer (and slower) the transition.

Direction Pop-Up
Some transitions (e.g., Slide, Push and Wipe) have associated directions. Use this pop-up to select a direction for the transition effect.

Rate Field
Use this field to select the speed of the transition. Values for this field can range from 0 (slowest) to 100 (fastest). Note that the speed setting is processor dependent—different computers will render the transition at different speeds, based on the speed of the computer.

- *Note: On faster computers, even medium speed settings may make the transition happen too quickly to be noticed. If a transition seems not to be working, try lowering the rate to a very low setting (e.g., 0 or 1) and increasing the number of steps. Then incrementally increase the rate until the effect appears at the desired speed.*

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SET MODIFIER

The set modifier can be used to change the value of a variable, or the value of incoming data, to a new value on receipt of a specified message. This modifier is useful for simple functions, such as resetting scores to 0 when leaving a scene. It can also be used in more complex operations, such as setting the value of a aliased variable to the value of another variable during runtime.

Using the set modifier to change the value of a variable is equivalent to the Miniscript assignment statement:

```
set variableName to expression
```

where *variableName* is the name of a valid variable in the current project and *expression* is a Miniscript expression that evaluates to the proper type for storage in the variable. However, the set modifier executes faster, makes projects easier to understand, and should be used in preference to single-line Miniscript assignment statements.

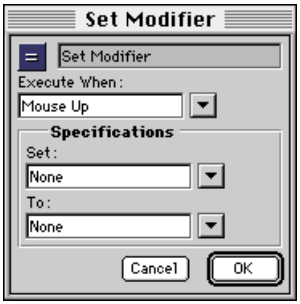


Figure 12.42 The set Modifier dialog

Components of the set modifier dialog (Figure 12.42) are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Execute When Pop-Up Menu

Use this pop-up menu to select the message that triggers the set operation. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

The controls in this section specify the variable or property to be set and the new value.

Set Pop-Up Menu

Select the data or variable to be changed from this pop-up. Options include:

- **None**: This is the default selection. No data or variable is changed on receipt of the specified message.
- **Incoming Data**: Choose this option to set the incoming data (i.e., the value that arrives with the message that triggers the set modifier) to the value entered in the To field.

- **Variable**: Any variable modifier in the set modifier's scope can be specified to be changed. The variable modifiers will be visible in the Set pop-up. Variables are only available to those modifiers or Miniscripts in its scope. For information regarding scoping rules, see "Variable Scopes" on page 13.253.

To Pop-Up Menu

Use this menu to select the data or variable to which the item specified in the Set pop-up is to be changed. The choices on this pop-up are None, Incoming Data and any variables to which the element has access. A data value can be sent by highlighting the To text field and typing in a value. These menu items are described in more detail below:

- **None**: This is the default selection. No set operation is performed (i.e., the selected value is not changed).
- **Incoming Data**: Choose this option to configure the messenger to set the item in the Set field to the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger).
- **Variables**: To set the item in the Set field to a variable, select its name from the submenus available in the second section of the To pop-up menu. All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only accessible to those modifiers or Miniscripts in its "scope." See "Variable Scopes" on page 13.253.
- **Constant Data Value**: To set the item in the Set field to a constant data value, highlight the To text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

Cancel Button

Click Cancel to ignore changes made to this modifier.

OK Button

Click OK to accept changes made to this modifier.

SHARED SCENE MODIFIER

The shared scene modifier can be used to specify a scene to become the shared scene. Note that by default there is always one, and only one, shared scene in a subsection (this behavior can be changed, however, see the description of the attribute "autoSharedScene" on page 15.278).

The new shared scene replaces the current shared scene. The displaced shared scene becomes a "regular" scene—the first regular scene in the subsection. Any other scenes in the subsection "move" in the scene order to accommodate the new first scene. Note, however, that the currently active scene (the one visible to the user) does not change except to display the new shared scene as its background. More information about shared scenes can be found in "The Shared Scene" on page 9.93 and "Shared Scenes" on page 10.96.

Components of the shared scene modifier dialog (Figure 12.43) are described below:

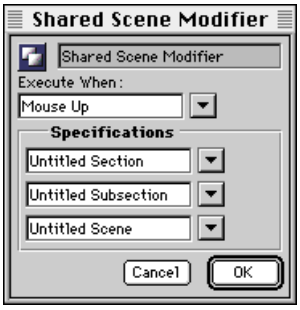


Figure 12.43 The Shared Scene Modifier dialog.

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that causes the new shared scene to be set. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Select the scene to become the shared scene from the pop-up menus in this section. The first pop-up selects a section, the second selects a subsection, and the third selects the scene for specifying the new shared scene.

The default is the current section, current subsection and current scene. Note that the scene default should *always* be changed because if the current scene is targeted to become the shared scene, nothing happens (i.e., the shared scene is not changed). Note that this is true when any shared scene modifier (no matter where it is located) attempts to make the current scene the shared scene.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SIMPLE MOTION MODIFIER

The simple motion modifier applies pre-defined motion paths to elements, including text, graphics, mToons, and video elements. Simple directional motion or random movement can be selected.

Components of the simple motion modifier dialog (Figure 12.44) are described below:

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Execute When Pop-Up Menu

Use this pop-up menu to select the message that enables the element motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

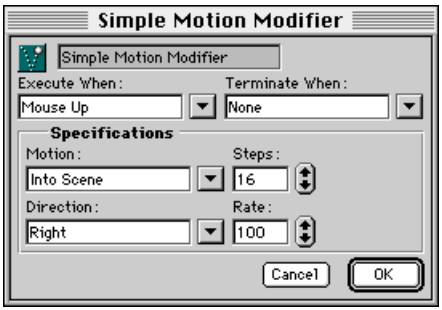


Figure 12.44 The Simple Motion modifier dialog

Terminate When Pop-Up Menu

Use this pop-up menu to select the message that stops the element motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to customize the simple motion.

Motion Pop-Up Menu

Use this pop-up menu to select a basic motion type. Options include:

- **Into Scene**: The object moves into the scene to its current position as defined in the layout window.
- **Out of Scene**: The object moves off the scene from its current position as defined in the layout window.
- **Random Bounce**: The object bounces around at random angles within the frame of its parent.

Steps Field

Use this field to set the number of positions between start and end points of the motion path. The greater the number, the finer and slower the animation. This field is not available for all motion types.

Direction Pop-Up Menu

If the motion chosen has an associated direction, this pop-up becomes visible. Use this menu to select a direction for the simple motion.

Rate Field
Use this field to set a speed of the motion. Note that this speed is not absolute, but varies depending on the speed of the playback computer.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SOUND EFFECT MODIFIER

The sound effect modifier can be used to play sound effects in response to a message.

AIFF files can be linked to the project and played from this modifier. Note that the sound effect *modifier* is not the same as a sound *element*. The sound effect modifier is designed for playing a sound once in response to a specific message. Sound elements are more flexible—they can contain modifiers, they can be looped, and a sound element's sound will continue to play across scene changes. The sound effect modifier, however, is very useful for setting up simple sound effects.

Components of the sound effect modifier dialog (Figure 12.45) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

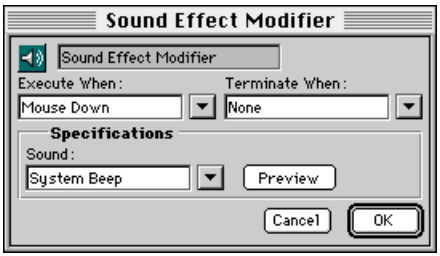


Figure 12.45 The Sound Effect Modifier dialog

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that starts the sound effect. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Terminate When Pop-Up Menu
Use this pop-up menu to select the message that terminates the sound effect. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229. Note that sound effect modifiers also stop playing when the scene is changed.

Sound Pop-Up Menu
Use this pop-up to select a sound that has been linked to the project. Alternatively, select Link Sound from this menu to link a new sound. A standard file dialog appears.

The current system beep of your computer is the default setting of this modifier. Note however, that the system beep is different on different machines, so don't rely on this sound being the same during runtime on other machines. Also, the system beep is a special system sound that does not play in the same way as other sounds—if the system beep is triggered multiple times in quick succession, the "beeps" do not play in tandem (as other mTropolis sounds would do), but play one after another.

Preview Button
Click this button to preview the sound currently selected in the Sound pop-up.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SOUND FADE MODIFIER

The sound fade modifier decreases or increases the volume of a sound element. For example, this modifier can be used to obscure the abrupt halt of background audio by fading it to zero volume before the sound ends.

Note that this modifier only effects sound elements and video elements that play audio (e.g., QuickTime elements). This modifier has no effect when attached to graphic elements, even if that graphic element has a *sound effect* modifier (see page 12.208) attached.

Components of the sound fade modifier dialog (Figure 12.46) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

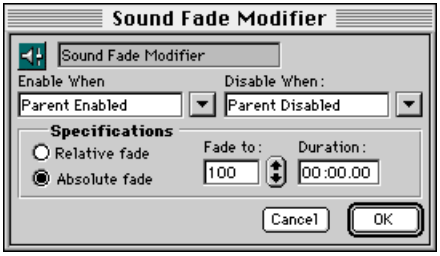


Figure 12.46 The Sound Fade Modifier dialog

Enable When Pop-Up Menu
Use this pop-up menu to select the message that starts the sound fade. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Disable When Pop-Up Menu
Use this pop-up menu to select the message that stops the sound fade. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Relative Fade Radio Button
Select this button to specify a sound fade relative to the sound's current volume. This fade is specified as a percentage from 0 to 10,000% in the "Fade to:" field.

Absolute Fade Radio Button
Select this button to specify a sound fade to an absolute volume. This fade is specified as a percentage from 0 to 100% in the "Fade to:" field.

Fade To Field
Use this field to specify the volume level to which the sound fades. The meaning of this field changes depending upon which radio button is selected:

- If the Relative Fade button is selected, this field specifies a percentage of the sound's *current* volume. Valid values range from 0 (no sound) through 100 (no change to current sound) to 10000 (increase the current sound level by 100 times). Note that the sound can only fade up to its full volume

level, no matter what this value is set to (i.e., the sound is never *amplified* by mTropolis).

- If the Absolute Fade button is selected, this field specifies a percentage of the sound's *full* volume. Valid values range from 0 (no sound) to 100 (sound played at full volume). If a value greater than 100 is entered in this field, the sound fades to its full volume and the value will be shown as 100 the next time this dialog is opened.

Duration Field
Use this field to specify the duration of the fade in `minutes:seconds.hundredths` format.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

SOUND PANNING MODIFIER

The sound panning modifier changes the stereo position (i.e., the left/right balance) of a sound element or the sound in a video (e.g., QuickTime) element. Note that this modifier cannot modify a sound being played by the sound effect modifier, only sound elements and the sound portion of video elements can be modified. Sound elements can only be added in the structure view—for details, see "To create a new sound element:" on page 8.85.

- *Note: On Macintosh, all sounds can be made to pan. On Windows platforms, only stereo sounds can be made to pan. Mono sounds do not pan.*

Components of the sound panning modifier dialog (Figure 12.47) are described below.

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

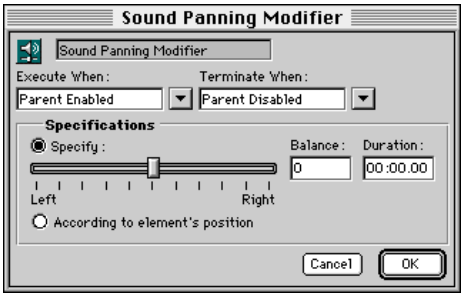


Figure 12.47 The Sound Panning Modifier dialog

Execute When Pop-Up Menu

Use this pop-up menu to select the message that activates the sound panning. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Terminate When Pop-Up Menu

Use this pop-up menu to select the message that ends the sound panning. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to specify the type of pan to be performed.

Specify Radio Button

Select this radio button to set a specific panning position for the sound. When this option is selected, three other interface elements become active:

- **Left/Right Slider**: Use this slider to select the pan position of the element. The Balance text field updates to reflect the position of the slider.
- **Balance Field**: This field can be used to enter a precise pan position. A value of -100 indicates full left, 0 indicates center, and 100 indicates full right. The Left/Right slider updates to reflect the value entered in this field.
- **Duration Field**: Use this field to specify the time it takes for the sound to pan from its current position in the stereo field to the position specified by the Left/Right slider or

Balance field. This value should be entered in `minute:second.hundredths` format. The default, 00:00.00 means that the pan position changes instantaneously.

According to Element's Position Radio Button
Select this radio button to deactivate the Left/Right, Balance, and Duration controls and instead specify the pan position of the sound according to the element's left/right position in the scene. When the element is positioned at the left edge of the scene, its sound is panned full left. When the element is positioned at the right edge of the scene, its sound is panned full right. The panning changes smoothly as the element is positioned between the two extremes.

Hot Tip

Use this option in conjunction with the drag motion modifier (page 12.147) to create video or sound elements whose sound panning changes in real time as they are moved about the screen by the user. Note that sounds, since they don't have a physical representation in the layout view, inherit "position" information from the element that is their parent.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

STRING VARIABLE

String variable modifiers hold ASCII text values. String variables can hold up to 32K bytes of text. They are useful for storing user names, and other text values that may change during runtime.

Components of the string variable dialog (Figure 12.48) are described below:

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Text Field
Enter the variable's initial value here. The value is checked for validity when the OK button is clicked. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

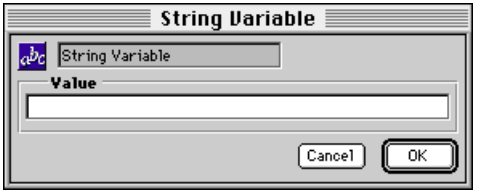


Figure 12.48 The String Variable dialog

TEXT STYLE MODIFIER

The text style modifier can be used to change the settings of all text in a text element. Like the graphic modifier, multiple text style modifiers can be added to a text element, but the effects of only one text style modifier can be applied at once.

The default text style of a text element can be changed using the options in the Format menu. The text style modifier, Format menu options, and cross-platform text issues are discussed in detail in Chapter 4, "Format Menu".

Components of the text style modifier dialog are described below:

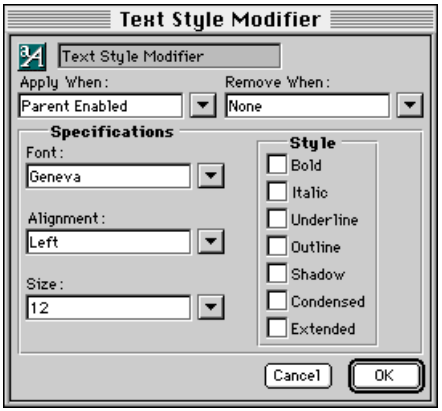


Figure 12.49 The Text Style modifier dialog

Modifier's Name Field

This editable text field can be used to change the modifier's name.

Modifier Icon

This icon identifies the modifier's type.

Apply When Pop-Up Menu

Use this pop-up menu to select the message that causes the specified text style to be applied. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

Remove When Pop-Up Menu

Use this pop-up menu to select an optional message that causes the text effects to be removed. For a complete discussion of this menu, see "When Pop-Up and Message/ Command Pop-Up Options" on page 13.229.

Specifications Section

Use the controls in this section to select the text style to be applied.

Font Pop-Up Menu

Use this pop-up to select the font to be applied. All fonts installed on the current system are shown in the menu.

- *Note: When a project is built into a title for distribution, fonts are not bundled into the build file. To display properly, any fonts used by the project must be installed on the target system.*

Alignment Pop-Up Menu

Use this pop-up to select the alignment of the text. Options are Left, Center or Right, relative to the frame of the text element.

Size Pop-Up Menu
Use this pop-up to specify the size of the text, in points.

Text Style Checkboxes
Select text style options, if desired, by selecting any of these checkboxes.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

TIMER MESSENGER

The timer messenger can be used to send a message after a given time has elapsed. The message can be sent once or repeatedly.

One common use for the timer messenger is to implement "looping" behavior in mTropolis. If the modifier's "Loop timer" checkbox is selected, the messenger sends its message repeatedly at the specified time interval. The message is sent repeatedly from the time the timer is started (i.e., when it receives the message specified in its "Execute When" pop-up) until the timer is stopped (i.e., when it receives the message specified in its "Terminate When" pop-up). Other modifiers in the project can be configured to perform their actions when they receive the message sent by the timer messenger. Thus, the actions occur repeatedly.

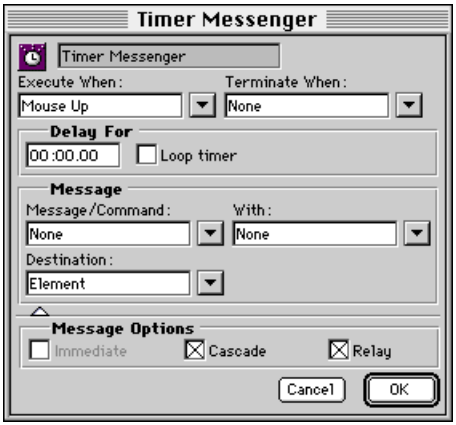


Figure 12.50 The Timer messenger dialog

Components of the timer messenger dialog (Figure 12.50) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that causes the timer to start. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Terminate When Pop-Up Menu
Use this pop-up menu to select an optional message that causes the timer to stop. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Delay For Section
Enter the duration of the timer in this section's text field using the format `minutes:seconds.hundredths`. The timer starts when it receives the message specified by the "Execute When" pop-up menu. After the specified time has elapsed, the message specified by the "Message" section is sent.

Loop Timer Checkbox
By default, the timer runs once and sends its message once at the end of the "Delay For" time. Select the "Loop timer" checkbox to

make the timer restart and send its message repeatedly until the timer is stopped by the message specified in the "Terminate When" pop-up.

Message Specifications
Use this section to specify the message to be sent when the "Delay For" time has elapsed.

See "Configuring Messenger Modifiers" on page 12.126 or "Message Specifications" on page 12.171 for a complete description of the controls in this section.

Message Options
Click the triangle at the bottom of the dialog to display the Message Options section. See "Message Options" on page 12.128 or "Message Options" on page 12.172 for a complete description of the controls in this section.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

TRACK CONTROL MODIFIER

The track control modifier can be used to manipulate the video and audio tracks within a QuickTime movie element. QuickTime movies consist of tracks—individual video and audio elements that can be manipulated separately, or in unison, by this modifier. Tracks can be turned on, turned off, or toggled between the two states using this modifier.

All QuickTime movies have at least one track. However, QuickTime movies can be made that consist of multiple tracks. mTropolis includes a separate Macintosh application called MovieTrax that can be used to create your own multitrack QuickTime movies for use in mTropolis projects. See Appendix A, "MovieTrax", for a description of this application.

- *Note: Because of limitations in the current version of QuickTime, this modifier is not fully supported under Windows. See "Behavior of the Track Control Modifier on Windows Platforms" on page 12.220.*

Components of the track control modifier dialog (Figure 12.51) are described below.

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that triggers the track control modifier. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Track Selection Section

Use the controls in this section to specify the track or tracks to be affected by the operation specified in the Track Options section.

All Tracks Radio Button
Select this button to specify all tracks in the movie.

All Visual Radio Button
Select this button to specify all video tracks in the movie.

All Audio Radio Button
Select this button to specify all audio tracks in the movie.

Use Incoming Data Radio Button
Select this button to specify tracks via the data accompanying the message that triggers the

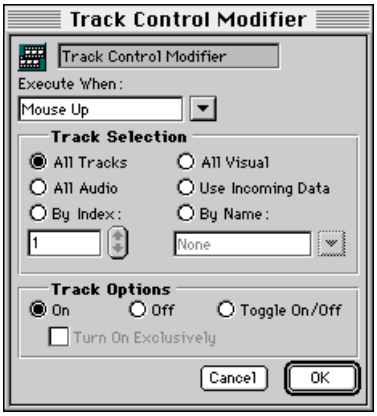


Figure 12.51 The Track Control Modifier dialog

track control modifier. Acceptable data types are a string (that contains the name of the track to be selected), an integer (that contains the index of the track to be selected), or an integer range (that specifies a range of track indices to be selected).

By Index Radio Button
Select this button to specify a single track by its index number. The By Index field becomes active. Enter an index number in the field or use the arrows to select one. Note that it is possible to select an index that is not actually present in the movie.

By Name Radio Button
Select this button to specify a single track by its name. The By Name pop-up menu becomes active. The names of tracks that have names assigned to them appear as the menu options.

Track Options Section

Use the controls in this section to specify the type of operation to perform on the selected track(s).

On Radio Button
Select this button to enable the selected tracks (i.e., turn them "on").

Off Radio Button
Select this button to disable the selected tracks (i.e., turn them "off").

Toggle On/Off Radio Button
Select this button to enable any selected tracks that are currently disabled and disable any selected tracks that are currently enabled.

Turn On Exclusively Checkbox
When the "On" radio button is selected, this checkbox can also be selected to turn *off* all QuickTime tracks except for the ones the modifier is configured to turn on.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

BEHAVIOR OF THE TRACK CONTROL MODIFIER ON WINDOWS PLATFORMS

QuickTime for Windows does not support multitrack QuickTime movies in the same way as QuickTime for Macintosh. Specifically, QuickTime for Windows recognizes only one video track in a QuickTime movie regardless of the number of video tracks it actually contains.

When the track control modifier is used in titles built for Windows platforms, the following restrictions apply:

- Only one video track is recognized. The video track with the lowest QuickTime layer number is the only one recognized. The MovieTrax utility can be used to change the order of QuickTime tracks. See "List Window" on page A.313.
- Track index numbers may change as a result of multiple video tracks being ignored. For example, consider a movie with two video tracks and two audio tracks. Suppose these

tracks were layered with MovieTrax such that video track 1 is the front-most track, followed by video track 2, audio track 1, and audio track 2.

On Macintosh, these tracks could be accessed by index number as indexes 1 through 4 (i.e., video track 1 is at index 1, video track 2 is at index 2, audio track 1 is at index 3, and audio track 2 is at index 4). However, when built for Windows, video track 2 will be ignored. Therefore, the index numbering of the track changes such that video track 1 is at index 1, audio track 1 is at index 2, and audio track 2 is at index 3.

As a result, the track control modifier will behave differently under Windows. In our example, track index 4 could be turned on or off in a Macintosh title, but that track index would be unavailable on the Windows title.

- Similarly, track names may become confused if there are multiple video tracks in the movie. mTropolis simply maps track names to index numbers.
- When used in titles built for Windows platforms, this modifier is best used with QuickTime movies that have only one video track and multiple audio tracks. For such movies, the track control modifier will work identically on both Macintosh and Windows.

VECTOR VARIABLE

The vector variable modifier stores angle and magnitude values for use with the vector motion modifier (see "Vector Motion Modifier" on page 12.223).

Variable's Name Field
This editable text field can be used to change the variable's name. If the variable will be referenced in a Miniscript modifier, it is good programming practice to make the name a single word.

Modifier Icon
This icon identifies the variable modifier's type.

Value Fields
Enter the variable's initial values here or use the up/down arrow buttons to set the values by 0.5 increments. There are two fields:

- **Angle**: This is the vector's angle, measured in degrees counter-clockwise from horizontal (e.g., 0 degrees is at "3 o'clock", 90 degrees is at "12 o'clock").
- **Magnitude**: This is the vector's magnitude. The vector motion modifier interprets this magnitude as velocity in inches per second.

The value is checked for validity when the OK button is clicked. The value can be changed during runtime. See "Setting Values of Variable Modifiers" on page 14.261 for details regarding getting and setting the value of this variable modifier.

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

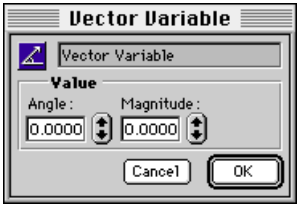


Figure 12.52 The Vector Variable dialog

VECTOR MOTION MODIFIER

The vector motion modifier applies a motion path to an element using the angle and magnitude values specified in a vector variable (see "Vector Variable" on page 12.222).

The vector motion of the element is tied to the specified vector variable. If the values in the vector variable are changed, the motion of the element changes to match the new values. The values of the vector variable modifier may be changed during runtime, providing many possibilities for an object's vector motion. For example, a graphic element could be configured to move in a straight line toward the user's cursor and then change direction as the mouse's location changes.

Components of the vector motion modifier dialog (Figure 12.53) are described below:

Modifier's Name Field
This editable text field can be used to change the modifier's name.

Figure 12.53 The Vector Motion modifier dialog

Modifier Icon
This icon identifies the modifier's type.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that initiates the vector motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Terminate When Pop-Up Menu
Use this pop-up menu to select the message that terminates the vector motion. For a complete discussion of this menu, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Vector Pop-Up Menu
Use this pop-up to select a previously defined vector variable as the model for the vector motion. Any variables currently available to the vector motion modifier from its position in the project's hierarchy will be visible in this pop-up (see "Variable Scopes" on page 13.253).

- *Note: A vector variable must be selected in this pop-up for any vector motion to happen.*

Cancel Button
Click Cancel to ignore changes made to this modifier.

OK Button
Click OK to accept changes made to this modifier.

Chapter 13. Modifier Pop-Up Menus and Message Reference

This chapter describes menus that are common to many of mTropolis' modifier dialogs. These menus include:

- **When Pop-Up Menu**: The menu used to select the message to apply/execute/enable or remove/terminate/disable the effects of a modifier. See "The 'When' Pop-Up Menu" on page 13.225.
- **Message/Command Pop-Up Menu**: The menu used to select the message or command to be sent from messengers. See "The Message/Command Pop–Up Menu" on page 13.226.
- **With Pop-Up Menu**: The menu used to specify the value to be sent with incoming messages or commands. See "The "With" Pop-Up Menu" on page 13.248.
- **Destination Pop-Up Menu**: The menu used to specify the destination for the message or command to be sent from messengers. See "The Destination Pop-Up Menu" on page 13.249.

The following topics are also covered in this chapter:

- "mTropolis Messages and Commands" on page 13.226.
- "Message Paths" on page 13.251.
- "Variable Scopes" on page 13.253

The settings specific to a modifier's capabilities are documented in the previous chapter, Chapter 12, "Modifier Reference".

THE 'WHEN' POP-UP MENU

Most modifier dialogs contain pop-up menus used to specify the messages that activate (or sometimes, deactivate) the modifier when they are received. These menus are referred to as When pop-up menus (Figure 13.1).

Each When pop-up in a modifier's dialog is labeled with a phrase that describes the action of the modifier when the selected message is received. This phrase helps to clarify the use of a When pop-up for each particular modifier. For example, "Execute When", "Terminate When", and "Apply When" are common When menu labels.

- *Note: Variable modifiers do not have When pop-ups as the value contained within the variable automatically becomes a part of the component on which it is placed.*

All When menus contain the same options. Types of messages are described in "mTropolis Messages and Commands" on page 13.226. For information about individual items in the When pop-up, see "When Pop-Up and

Message/Command Pop-Up Options" on page 13.229.

THE MESSAGE/COMMAND POP–UP MENU

Messenger modifier dialogs have a Message Specifications section, used to select the message to be sent when the messenger is activated, any extra data sent with the message, and the destination of the message.

The first menu in this section is the Message/Command pop-up menu (Figure 13.2). This menu lists all of the possible messages and commands that can be sent to elements in the project. They types of messages and commands that can be sent are described in the next section. For information about individual items in the When pop-up, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

mTROPOLIS MESSAGES AND COMMANDS

There are three types of options available in the Message/Command menu: environment messages, author messages, and commands. The When pop-up menu displays both author messages and environment messages that can be used to activate or deactivate modifiers. The three types of messages and commands are described below.

Environment Messages

In runtime mode, changes in the mTropolis environment, such as user mouse clicks, transitions, or scene changes, are detected by mTropolis' engine and reported to components of a project as messages. These messages are called *environment messages*. Environment messages are said to be generated "by mTropolis" or "by the mTropolis environment".

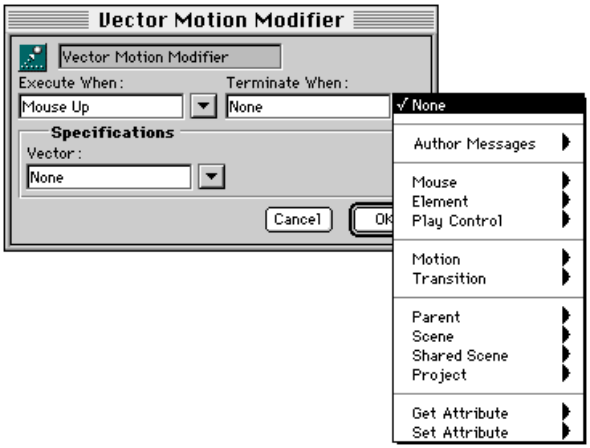


Figure 13.1 Typical mTropolis modifier dialog with When menus

Environment messages can be used to activate or deactivate modifiers by selecting them from the When pop-up menu. In this way, runtime events can be made to trigger modifiers. For example, the image effect modifier on the blue element in Figure 13.3 is configured to be applied by the environment message Mouse Down and removed by the environment message Mouse Up.

Sending Environment Messages from Messengers

In addition to being generated by runtime events, environment messages can also be sent from author-configured messengers. Select an environment message from the Message/Command pop-up menu to send an environment message to a specific element, just as if the runtime event associated with that message had occurred.

For example, consider the "Blue Square" graphic element in Figure 13.3. Its has an image effect modifier assigned to it. This modifier will be applied when the element receives a Mouse Down message. Therefore, the effect will be applied in runtime mode when a user starts to click on the element with the mouse. However, the image effect could also be triggered (without the user pressing the mouse button) by configuring a messenger to send a Mouse Down message to the Blue Square element.

This ability to send any environment message from a messenger gives the author flexible control over objects in a mTropolis project.

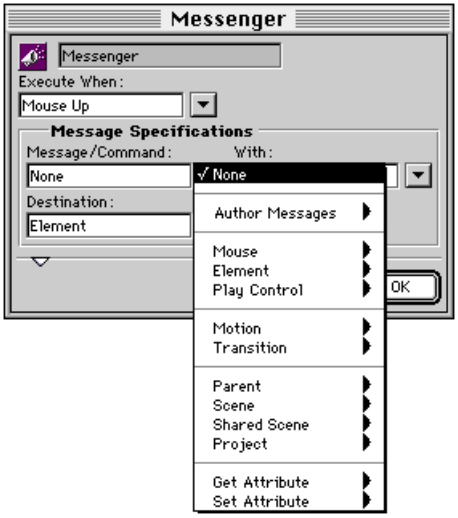


Figure 13.2 Typical messenger dialog with Message/Command menu

For information about individual environment messages, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

Author Messages

A message that has been created by the author of a mTropolis project is called an *author message*. Author messages are never sent by the mTropolis environment, they are only sent by messengers configured by the author. As with any other message, author messages can be used to activate or deactivate modifiers.

Previously-created author messages can be sent by selecting the message from the Author Messages submenu of the Message/Command pop-up. New author messages can be created simply by highlighting the text in the When or Message/Command text fields and entering new text. A dialog appears asking if you want to create the new author message. Once created, the new author message appears in the When menus of all modifiers and the Message/Command menu of all messengers.

Because modifiers respond to strings of words but not their meaning, the text of an author message is irrelevant. As long as the message that is sent to a modifier is the same as the message it is configured to receive, the modifier will be activated. For example, a change scene modifier could be configured to respond to the author message "Jump up!" When this message is received the change scene modifier activates and changes to the next scene in the project.

Commands

In addition to environment and author messages, the Message/Command menu allows the selection of *commands*. Commands are imperative instructions that are acted on by elements immediately upon receipt.

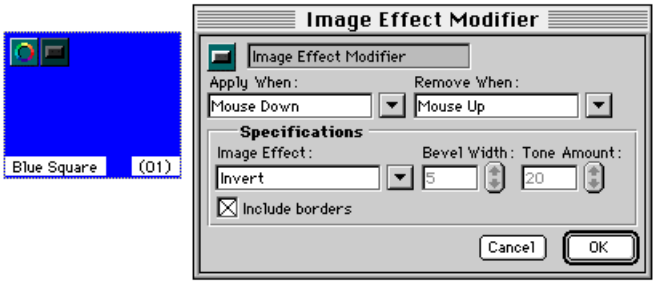


Figure 13.3 Activating and deactivating a modifier with environment messages.

Commands are different from messages in the following ways:

- A command constitutes a demand that the recipient perform some action, and it cannot be ignored. Commands are primarily used to control elements directly. For example, sending the *Play* command to an element causes any time-sensitive media (e.g., a QuickTime movie) linked to the element to start playing.
- Unlike messages, commands are not used to activate modifiers and are therefore not available in the When pop-up menu.
- Like author messages, commands are never sent from the mTropolis environment. They are always generated by author-configured messengers.
- Unlike either type of message, commands are sent to and acted on by a single, "targeted" destination. Commands do not "cascade" or "relay" through the scene.
- Although commands are targeted only at a single destination, some commands have associated messages that are generated by mTropolis when an element has responded to a command. These messages report the new state of an element. For example, when an element is sent the *Play* command, mTropolis generates a Played message that is sent to the element and its modifiers. These "message/command pairs" are described in "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.
- Command names are shown in *italic* type—in both the Message/Command menu and this manual—to differentiate them from messages.

For information about individual commands, see "When Pop-Up and Message/Command Pop-Up Options" on page 13.229.

WHEN POP-UP AND MESSAGE/ COMMAND POP-UP OPTIONS

The When and Message/Command menus are organized into a number of submenus that open to reveal the names of specific message and commands that can be sent. Each of the following sections details a different submenu:

AUTHOR MESSAGES

Previously-defined author messages can be selected from the Author Messages submenu. To create a new author message, highlight the text in the Message/Command text field and enter the name of the new message. A prompt appears, asking if you want to create the new author message. Author messages can also be created in the Author Messages Window (see "Author Messages Window" on page 7.77).

How mTropolis Handles Author Messages

By default, author messages sent from messengers "cascade" from the targeted destination to every component below it in the project's hierarchy. This feature allows many modifiers to be activated by a single message.

For example, a messenger could be configured to send an author message called "SetSpeed" with a value of 10 to a scene. Messengers on mToons in the scene can be configured to respond to this author message by setting the frame rate of their animations with the incoming data. When the author message "Set Speed" and the value 10 is received by the scene, it is automatically broadcast from the scene to its elements and modifiers, causing the messengers on the mToons to collectively set the frame rates of their animations to 10.

Messages can be more precisely targeted by altering the default message options in the messenger dialog. See "Message Options" on page 13.252 or page 12.128.

Using Author Messages in the When Pop-Up

Select an author message from this menu to specify the message that activates or deactivates the modifier.

Using Author Messages in the Message/ Command Pop-Up

Select an author message to be sent to a targeted destination from this pop-up.

MOUSE MESSAGES

Choose Mouse in the When pop-up or the Message/Command pop-up to reveal the submenu options related to this item (Figure 13.4).

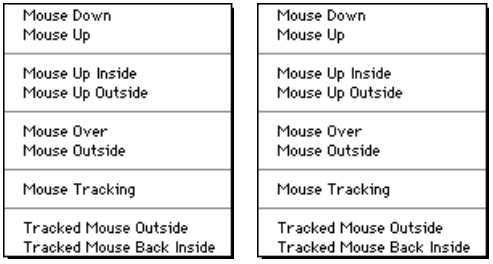


Figure 13.4 Mouse messages in the When and Message/Command pop-up menus

How mTropolis Generates Mouse Messages

During runtime, mTropolis sends mouse messages in response to a user's mouse actions. When the mouse action is detected, the appropriate messages are sent to the element under the mouse cursor and passed to its modifiers.

If elements that are layered over each other are each configured with modifiers to respond to the same mouse messages, only the element closest to the viewer (i.e., the element with the highest layer order number) under the user's mouse receives mouse messages from mTropolis.

Hidden elements neither receive nor do they act on mouse messages sent by mTropolis. However, modifiers on a hidden element that act on mouse messages can be triggered by sending mouse messages to the hidden element from a messenger modifier.

Note that, for performance reasons, mouse messages such as Mouse Over and Mouse Outside are only sent when the user moves the mouse cursor over an element. Messages are *not* generated when moving elements pass under a stationary cursor. See the description of "refreshCursor" on page 15.290 for information on detecting such events.

Using Mouse Messages with the When Pop-Up

Select a mouse message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

By default, the cursor changes to "hand up" when moved over an element that is sensitive to mouse messages. This behavior can be changed using the cursor modifier (page 12.146).

Using Mouse Messages with the Message/ Command Pop-Up

Select a mouse message in a Message/ Command menu to send the mouse message to a targeted destination as if the message had been generated by the user's mouse actions. Note that sending one of these messages does not actually cause the mouse cursor (or the mouse itself!) to move.

Data Sent with Mouse Messages

When sent by the mTropolis environment, all mouse messages are sent with point data indicating the screen position at which the event occurred. Mouse messages sent by the author can also be sent with point data to provide a simulated position for the author-generated mouse event.

Mouse Message Descriptions

Mouse message options found in the When and Message/Command pop-up menus are described below:

Mouse Down

mTropolis sends a Mouse Down message to an element when the mouse button is pressed down and the mouse cursor is over that element. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Up

mTropolis sends a Mouse Up message to an element when the mouse button has been

pressed down over that element and then released anywhere. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Up Inside
mTropolis sends a Mouse Up Inside message to an element when the mouse button has been pressed down over that element and then released *inside the frame* of that element. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Up Outside
mTropolis sends a Mouse Up Outside message to an element when the mouse button has been pressed down over that element and then released *outside the frame* of that element. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Over
mTropolis sends the Mouse Over message to an element when the mouse cursor passes over the frame of that element in an inward direction. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Outside
mTropolis sends the Mouse Outside message to an element when the mouse cursor leaves the frame of an element. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Mouse Tracking
mTropolis sends the Mouse Tracking message to an element repeatedly after the mouse button has been pressed over that element and is being held down and moved (i.e., the mouse cursor is being dragged) over the element. The message is sent until the mouse button is released. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Tracked Mouse Outside
mTropolis sends the Tracked Mouse Outside message to an element when Mouse Tracking has started (i.e., after the user has started a drag motion over the element), and the mouse cursor is dragged outside the frame of that element. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

Tracked Mouse Back Inside
mTropolis sends the Tracked Mouse Back Inside message to an element after the Tracked Mouse Outside condition has been met (i.e., after the user has started a drag motion over the element, but continued dragging outside the element's frame) and the mouse cursor is dragged back inside that element's frame. As with all mouse messages, mTropolis sends point data with this message, indicating the position at which the event occurred.

ELEMENT MESSAGES AND COMMANDS

Choose Element in the When or Message/Command menu to reveal the submenu items described below (Figure 13.5).

How mTropolis Handles Element Messages and Commands

Most of the Element submenu items in the Message/Command menu are commands. Commands are not sent by mTropolis, they can only be sent from messengers.

With the exception of Edit Done, the element environment messages listed in the When pop-up are only sent by mTropolis when it detects an element that has responded to a command. mTropolis notifies the element of its changed state by sending the environment message to the element and its modifiers.

mTropolis sends the Edit Done environment message to an element and its modifiers when the user has clicked off of an editable text element during runtime.

Using Element Messages with the When Pop-Up

Select an element message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Element Messages and Commands with the Message/Command Pop-Up

With the exception of Edit Done, every item on the Message/Command pop-up's Element submenu is a command. Select an element message or a command to send to a targeted destination from this menu.

Element Option Descriptions

The following element-related options are available in the When and Message/

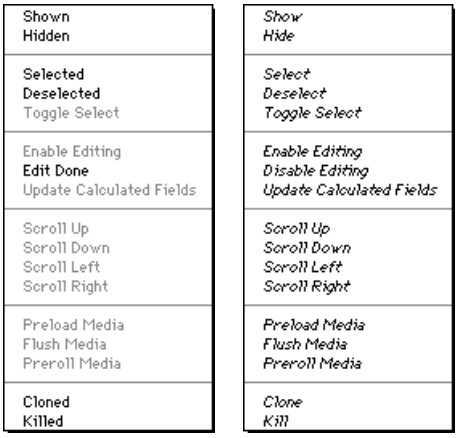


Figure 13.5 Element messages in the When and Message/Command pop-ups

Command windows. Note that some options are available in only one menu. Other options are described as related message/command pairs. The message, found in the When menu (e.g., "Shown"), is described first, followed by the command (e.g., "*Show*"), found in the Message/Command menu, that (when received by an element) causes the message to be generated.

Shown/Show
mTropolis sends a Shown message to an element when it becomes shown (in response to a *Show* command). Send the *Show* command to a hidden element to make it visible.

Hidden/Hide
mTropolis sends a Hidden message to an element when it becomes hidden (in response to a *Hide* command). Send the *Hide* command to a visible element to make it invisible (and unresponsive to user mouse events). To create invisible elements that *do* respond to user mouse events, consider applying the "Invisible" ink effect (page 11.108).

Selected/Select
mTropolis sends a Selected message to an element when it receives a *Select* command. Send the *Select* command to an element to set some author-defined state to "on". *Select* commands can only be sent by messengers—the mTropolis environment never sends *Select*.

- *Note: The Select command has nothing to do with user mouse actions. See "Mouse Messages" on page 13.230 for messages sent in response to user mouse motions and clicks.*

Deselected/Deselect
mTropolis sends a Deselected message to an element when it receives a *Deselect* command. Send the *Deselect* command to an element to set some author-defined state to "off". *Deselect* commands can only be sent by messengers—the mTropolis environment never sends *Deselect*.

- *Note: The Deselect command has nothing to do with user mouse actions. See "Mouse Messages" on page 13.230 for messages sent in response to user mouse motions and clicks.*

Toggle Select (Message/Command Menu Only)
Send the *Toggle Select* command to an element that has previously received the *Select* or *Deselect* commands to reverse the element's current selection state. When a "selected" element receives *Toggle Select*, mTropolis sends a Deselected message to the element. When a "deselected" element receives *Toggle Select*, mTropolis sends a Selected message to the element.

Enable Editing (Message/Command Menu Only)
The *Enable Editing* command can be used to make a text element editable (i.e., the contents of the element can be changed by the user in runtime mode). Send *Enable Editing* to a text element to make it editable. Upon receipt of this command, the text element becomes editable, and an insertion point appears in the text. The text element remains editable until the user clicks outside of the text element to indicate that text entry is complete, or until the text element receives a *Disable Editing* command. To make a text element editable without immediately putting an insertion

point in the text, use the "editable" attribute (described on page 15.282).

- *Note: When an element is being edited, any active graphic modifiers are ignored and the text is displayed with a black foreground, white background, and "Copy" ink effect. The element is restored to its original appearance when editing is finished.*

Disable Editing (Message/Command Menu Only)
The *Disable Editing* command can be used to return editable text elements to their non-editable state. Send *Disable Editing* to a text element that is currently being edited to return it to its default state (i.e., there is no insertion point in the text). When an element receives the *Disable Editing* command, mTropolis also sends an Edit Done message to the element.

Edit Done (When Pop-Up Menu Only)
mTropolis sends the Edit Done message to an editable text element when the user finishes text entry by clicking outside the text element. This message is also sent to an element that receives the *Disable Editing* command.

Update Calculated Fields (Message/Command Menu Only)
Send the *Update Calculated Fields* command to a text element to update any calculated fields displayed in the element. Any placeholders (i.e., variable names enclosed by the < and > symbols) are updated to show the current value of the specified variable. See "Calculated Fields—Displaying Variables in Text Fields" on page 4.55.

Scroll Up (Message/Command Menu Only)
Send the *Scroll Up* command to move the content of an element *down* within its frame. That is, this command emulates the behavior of the up-pointing arrows commonly found on scrolling interface elements. Specify the amount in pixels that the content is to move by sending a value using the "With" field. As the content of the element moves, it will be cropped by the frame of the element.

Scroll Down (Message/Command Menu Only)
Send the *Scroll Down* command to move the content of an element *up* within its frame. That is, this command emulates the behavior of the down-pointing arrows commonly found on scrolling interface elements. Specify the amount in pixels that the content is to move by sending a value using the "With" field. As the content of the element moves, it will be cropped by the frame of the element.

Scroll Left (Message/Command Menu Only)
Send the *Scroll Left* command to move the content of an element *right* within its frame. That is, this command emulates the behavior of the left-pointing arrows commonly found on scrolling interface elements. Specify the amount in pixels that the content is to move by sending a value using the "With" field. As the content of the element moves, it will be cropped by the frame of the element.

Scroll Right (Message/Command Menu Only)
Send the *Scroll Right* command to move the content of an element left within its frame. That is, this command emulates the behavior of the right-pointing arrows commonly found on scrolling interface elements. Specify the

amount in pixels that the content is to move by sending a value using the "With" field. As the content of the element moves, it will be cropped by the frame of the element.

Preload Media (Message/Command Menu Only)
Send the *Preload Media* command to an element to load that element's associated media file into system memory (RAM) for optimal playback. This command can only be sent to elements that contain mToons, video, and audio media (the equivalent for still graphics is the "cache bitmap" setting—see "Cache Bitmap Checkbox" on page 6.64).

The *Flush Media* command can be used to remove preloaded media from memory. mTropolis will also automatically unload preloaded media when the scene changes or when a low memory situation occurs. However, the priority of preloaded media can be changed as described in "flushPriority" on page 15.283.

- *Note: This option is limited by the memory available to the project at runtime. Use caution when sending this command as exceeding the available memory on machines that play your title can cause unpredictable behavior, including program crashes. Pay attention to the size of media you are attempting to preload. For example, on most machines, it is not a good idea to attempt to preload a 40 megabyte QuickTime video.*

Flush Media (Message/Command Menu Only)
Send the *Flush Media* command to an element to flush its associated media from memory. This command is useful for removing media that was previously loaded into memory using the *Preload Media* command.

Preroll Media (Message/Command Menu Only)
Send the *Preroll Media* command to an mToon, video, or sound element to perform caching and initialization of the media so that it can respond more quickly to the next *Play* command. This command is especially useful with sound elements which usually must take time to load from disk into a memory buffer before they actually begin playing. Note that once the media has been played, it is no longer "prerolled".

Cloned/Clone
mTropolis sends a Cloned message to an element when it has been created with the *Clone* command. Send the *Clone* command to an element to create a new instance of that element. The clone command can be sent to any media element, but has no effect when sent to larger structural components (i.e., subsection, section, and project components). The newly-created element has exactly the same properties as the original, including name, position, appearance, and modifiers with the following exceptions:

- The new element occupies the next highest layer order number. Any existing elements in higher layer orders move up one layer to accommodate the new element, if necessary.
- The new element becomes the original element's "next" sibling. All existing siblings of the original element move one

position later in the message passing order to accommodate the new element. Therefore, the most recent clone of an element could be targeted in Miniscript expressions as `element.next`. If there are two clones of an object the first clone could be addressed as `element.next.next` and the second clone (e.g., the most recent one) as `element.next`.

- Internally, each mTropolis element has a unique ID. Therefore, though clones have the same "name" as the original element, they do not automatically receive messages targeted at the original by name. They are completely autonomous elements.

- *Note: If the runtime Player Emulation option is turned off (i.e., if the **File-Run-Player Emulation** menu toggle is unchecked), clones are "persistent" between runtime and edit modes. That is, if a clone is created while examining a mTropolis project in runtime mode, the clone will exist as a new component upon returning to edit mode. The Kill command, described below, could be used to remove unwanted clones in runtime. Cloning is not persistent if **File-Run-Player Emulation** is checked (the default).*

Killed/Kill

mTropolis sends the Killed message to an element just before it is deleted from a project in response to the *Kill* command. Send the *Kill* command to an element to delete it from the project in runtime mode. The element and all of its children are removed from the project. *Kill* is most useful for deleting clones of objects, not original project elements, though it can be used to delete any element. The *Kill* command can be sent to any media element except for scenes. It has no effect when sent to larger structural components (i.e., subsection, section, and project components).

- *Note: Like the Clone command, the results of Kill are persistent between runtime and edit mode if the runtime Player Emulation option is turned off (i.e., if the **File-Run-Player Emulation** menu toggle is unchecked). That is, upon returning to edit mode, the killed element is no longer present in the project. Use caution (and the **File - Save** or **File - Save As** menu options) when testing projects that use the Kill command.*

PLAY CONTROL MESSAGES AND COMMANDS

The following section describes the items available in the Play Control submenu of the When pop-up and Message/Command pop-ups (Figure 13.6). These items are related to "playing" the contents of an element.

How mTropolis Handles Play Control Messages and Commands

Most of the items in the Play Control submenu are message/command pairs. With the exception of At First Cel and At Last Cel, the Play Control environment messages listed on the When pop-up are only sent by mTropolis when it detects an element that has responded to a corresponding Play Control command. Commands are not sent by mTropolis, they can only be sent from messengers.

mTropolis sends At First Cel or At Last Cel environment messages to an mToon element and its modifiers when the animation reaches its first or its last cel.

Using Play Control Messages with the When Pop-Up

Select a Play Control message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Play Control Messages and Commands with the Message/Command Pop-Up

Select a Play Control message or command in a Message/Command menu to send the message or command to a targeted destination.

Play Control Option Descriptions

Play control options found in the When and Message/Command pop-up menus are described below. Note that many of these options are described as related message/command pairs. The message, found in the When menu (e.g., "Played"), is described first, followed by the command (e.g., "*Play*"), found in the Message/Command menu, that (when received by an element) causes the message to be generated.

Played/Play

mTropolis sends a Played message to an element when it starts playing (in response to a *Play* command). Send the *Play* command to an element to show the element (if it is hidden) and start playing that element's associated media.

By default, the *Play* command starts the element's media playing from its beginning. However, this behavior can be changed by sending *Play* with a data value using the "With" pop-up menu. The type of value that can be sent depends upon the media type being played, as described below:

- **mToons**: When sending *Play* to an element that contains an mToon with predefined ranges, the "With" pop-up menu can be used to select an mToon range by name. Range names can be found under the "mToon Ranges" cascading menu item. For information about creating mToon ranges, see "Ranges" on page 2.28. When the

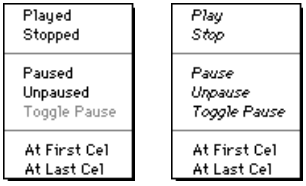


Figure 13.6 Play control messages in the When and Message/Command pop-up menus

element receives the *Play* command, only the cels in the specified range are played.

Alternatively, the *Play* command can be sent from Miniscript with the range name as accompanying (i.e., "with") data. Note that, when used this way, the range name should not be sent as a string (i.e., it does not have to be enclosed in quotation marks) but is instead simply referenced. For example, the following Miniscript statement sends the *Play* command to the mToon named "myToon" so that only the range named "myRange" is played:

```
send "Play" with myRange to myToon
```

Note that if an mToon is linked to the project and then removed, any ranges that mToon contained continue to show up in the "mToon Ranges" cascading menu.

- **QuickTime**: When sending *Play* to an element that contains a QuickTime movie, accompanying data values are ignored. However, ranges defined using the MovieTrax utility can be played by first setting the movie's range attribute to a string that contains the name of the range, then sending the *Play* command to the movie. Only the specified range will be played. The process of defining and using QuickTime ranges is described in detail in the MovieTrax appendix. See "New Range" on page A.309.
- **Sound**: When sending *Play* to an element that contains an AIFF sound file with predefined markers, the "With" pop-up menu can be used to select a marker by name. Marker names can be found under the "Sound Markers" cascading menu item. When the element receives the *Play* command, the sound starts playing from the selected marker point to the *next marker or the end of the sound file,* whichever comes first. Sound markers (sometimes also called *cue points*) can be added to AIFF files using an external sound editing application.

  Alternatively, the *Play* command can be sent from Miniscript with the sound marker name as accompanying (i.e., "with") data. Note that, when used this way, the range name should not be sent as a string (i.e., it does not have to be enclosed in quotation marks) but is instead simply referenced. For example, the following Miniscript statement sends the *Play* command to the sound element named "mySound" so that it starts playing from the "myMarker" sound marker:

  ```
  send "Play" with myMarker to mySound
  ```

  If multiple sound files and sound markers are being used in a project, ensure that all of the markers are given unique names. When mTropolis loads a sound file that contains a marker with the same name as a marker from a sound file already linked to the project, only the previously-linked marker shows up in the "Sound Markers" cascading menu. Note also that if a sound is linked to the project and then removed, any sound markers that sound contained continue to show up in the "Sound Markers" cascading menu.

- *Note: Though not every element has media associated with it (e.g., text elements), Play can be sent to any element type, causing the element to be shown (if it is hidden) and receive a Played message.*

Stopped/Stop
mTropolis sends a Stopped message to an element when it stops playing (in response to a *Stop* command). Send the *Stop* command to an element to stop playing that element's associated media and hide the element. To "stop" an element from playing without hiding it, use the *Pause* command.

- *Note: Though not every element has media associated with it (e.g., text elements), Stop can be sent to any element type, causing the element to be hidden and receive a Stopped message.*

Paused/Pause
mTropolis sends a Paused message to an element when its media pauses playing (in response to a *Pause* command). Send the *Pause* command to an element to temporarily stop playing that element's media, without hiding the element.

- *Note: Though not every element has media associated with it (e.g., text elements), Pause can be sent to any element type, causing it to receive a Paused message.*

Unpaused/Unpause
mTropolis sends an Unpaused message to an element when it unpauses playing (in response to an *Unpause* command). Send the *Unpause* command to an element to start playing that element's paused media once again. The media begins playing from its paused position.

- *Note: Though not every element has media associated with it (e.g., text elements), Unpause can be sent to any element type, causing it to receive an Unpaused message.*

Toggle Pause (Message/Command Menu Only)
Send the *Toggle Pause* command to an element that has previously received the *Pause* command or is currently playing to reverse the element's current pause state. That is, when a paused element receives *Toggle Select*, mTropolis starts playing its media and sends an Unpaused message to the element. When a currently-playing element receives *Toggle Select,* mTropolis pauses the media and sends a Paused message to the element.

At First Cel
mTropolis sends an At First Cel message to an mToon element when the animation reaches its first cel.

This message can also be sent to a targeted element to trigger any modifiers that act on At First Cel just as if the first cel in the animation had been reached. Note, however, that the animation does not actually change to the first cel when this message is received from a messenger.

At Last Cel
mTropolis sends an At Last Cel message to an mToon element and when the animation reaches its last cel.

This message can also be sent to a targeted element to trigger any modifiers that act on At

Last Cel just as if the last cel in the animation had been reached. Note, however, that the animation does not actually change to the last cel when this message is received from a messenger.

MOTION AND TRANSITION MESSAGES

Choose Motion or Transition in the When pop-up or the Message/Command pop-up to reveal the submenu options described below (Figure 13.7).

How mTropolis Handles Motion and Transition Messages

These messages are sent by mTropolis when it detects elements or scenes in motion. The motion or transition environment messages are sent to the element and its modifiers.

Using Motion and Transition Messages with the When Pop-Up

Select a motion or transition message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Motion and Transition Messages with the Message/Command Pop-Up

Select a motion or transition message in a Message/Command menu to send the message to a targeted destination just as if the mTropolis environment had generated the message. Note, however, that sending one of these messages does not actually make motion or a transition happen.

Motion Started

mTropolis sends a Motion Started message to an element and its modifiers when an element starts moving (e.g., when the user drags the element or the element starts simple, path, or vector motion).

Motion Ended

mTropolis sends a Motion Ended message to an element when its motion ends.

Transition Started

mTropolis sends a Transition Started message to an element when an element transition starts. Note that this message refers only to *element* transitions, not scene transitions (see "Scene Messages" on page 13.243).

Transition Ended

mTropolis sends a Transition Ended message to an element when its element transition ends.

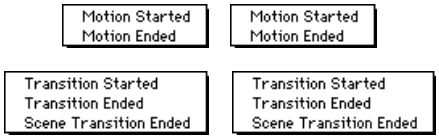


Figure 13.7 Motion and Transition messages in the When and Message/Command pop-up menus

Note that this message refers only to *element* transitions, not scene transitions (see "Scene Messages" on page 13.243).

Scene Transition Ended

mTropolis sends a Scene Transition Ended message to a scene after the scene has begun (i.e., after the Scene Started message) and any scene transition assigned to that scene (see "Scene Transition Modifier" on page 12.201) has finished playing. This message is useful because many scene transitions, such as "fade", create scenes that are not yet visible when the Scene Started message is sent. Note that this message is always sent, even if the scene does not contain a scene transition modifier. In this case, Scene Started is sent to the scene followed immediately by Scene Transition Ended.

PARENT MESSAGES

Choose Parent in the When pop-up or the Message/Command pop-up to reveal the submenu options described below (Figure 13.8).

How mTropolis Handles Parent Messages

mTropolis sends the Parent Enabled message to the scene when the scene starts. Unlike most environment messages, this message cascades through the scene, activating *all* modifiers and behaviors in a scene that are waiting for this message when the scene begins.

The Parent Enabled message is also sent to the components of a switchable behavior modifier when the behavior is switched on (i.e., when it receives the message specified in its Enable When field—see "Behavior" on page 12.129).

The Parent Disabled message is sent to the scene when the scene ends (by changing to another scene, exiting a mTropolis runtime application, or re-entering edit mode from runtime mode in the editor). This message also cascades through the scene, activating *all* modifiers and behaviors in a scene that are waiting for this message when the scene ends.

The Parent Disabled message is also sent to the components of a switchable behavior modifier when the behavior is switched off (i.e., when it receives the message specified in its Disable When field—see "Behavior" on page 12.129).

The Parent Changed message is sent to a component when its "parent" attribute has been changed.

Using Parent Messages with the When Pop-Up

Select a parent message in a When menu to activate or deactivate the modifier when the

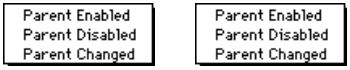


Figure 13.8 Parent messages in the When and Message/Command menus

message is received, either from mTropolis or from a messenger.

Using Parent Messages with the Message/ Command Pop-Up

Select a parent message in a Message/ Command menu to send the message to a targeted destination just as if the mTropolis environment had generated the message. Note, however, that sending one of these messages does not actually enable or disable the recipient's parent. In general, these messages should not be sent by the author.

Parent Enabled

mTropolis sends this message to an element when its parent is enabled. Elements are enabled when the scene starts; behaviors are enabled when they receive the message specified in their Enable When field.

Parent Disabled

mTropolis sends this message to an element when its parent is disabled. Elements are disabled when the scene ends; behaviors are disabled when they receive the message specified in their Disable When field.

Parent Changed

mTropolis sends this message to an element when it is reassigned to a new parent by changing the value of its "parent" attribute. See "parent" on page 15.288.

SCENE MESSAGES

Choose Scene in the When pop-up or the Message/Command pop-up to reveal the submenu options described below (Figure 13.9).

How mTropolis Handles Scene Messages

When navigating a multimedia title, actions often take place at the beginning and end of a scene. The scene messages are related to this functionality.

mTropolis sends the scene messages described below to the scene, its child elements and every modifier and behavior that has been placed on them.

Using Scene Messages with the When Pop-Up

Select a scene message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Scene Messages with the Message/ Command Pop-Up

Select a scene message in a Message/ Command menu to send the message to a targeted destination just as if the mTropolis environment had generated the message. Note, however, that sending one of these messages does not actually cause the current scene to start, end, deactivate, or reactivate.

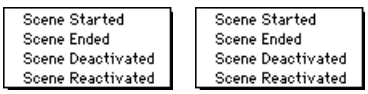


Figure 13.9 Scene messages in the When and Message/Command pop-up menus

Scene Started
mTropolis sends a Scene Started message to all elements of the scene, including the scene itself, the moment a scene begins.

Scene Ended
mTropolis sends a Scene Ended message to all elements of the scene, including the scene itself, when the scene ends (e.g., when a change scene modifier is executed).

Scene Deactivated
mTropolis sends this message to the scene and all of its elements when a change scene or navigation modifier is executed with the Add to Destination Scene checkbox selected (see "Change Scene Modifier" on page 12.136). This message is sent in lieu of the Scene Ended message.

Scene Reactivated
mTropolis sends this message to the scene when returning to that scene (via the return modifier—see "Return Modifier" on page 12.197) and that scene was previously changed *from* (via the change scene or navigation modifier) with the Add to Destination Scene checkbox selected. In other words, this message is sent when the scene is "reactivated" after having a new active scene "layered" over it. This message is sent in lieu of the Scene Started message.

SHARED SCENE MESSAGES

Choose Shared Scene in the When pop-up or the Message/Command pop-up to reveal the submenu options described below (Figure 13.10).

How mTropolis Handles Shared Scene Messages
Unlike most environment messages, mTropolis sends shared scene messages to the shared scene, its child elements, and every modifier that has been placed on them.

Using Shared Scene Messages with the When Pop-Up
Select a shared scene message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Shared Scene Messages with the Message/Command Pop-Up
Select a shared scene message in a Message/Command menu to send the message to a targeted destination just as if the mTropolis environment had generated the message. Note, however, that sending one of these messages does not actually cause the properties of the shared scene to change.

Returned To Scene
mTropolis sends a Returned to Scene message to the shared scene and its elements and

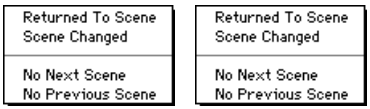


Figure 13.10 Shared scene messages in the When and Message/Command pop-up menus

modifiers when a return modifier is executed in the project during runtime.

Scene Changed
mTropolis sends a Scene Changed message to the shared scene, its elements and modifiers at the start of each scene during runtime.

No Next Scene
mTropolis sends a No Next Scene message to the shared scene, its elements and modifiers when a scene begins and that scene has no scenes following it (i.e., the scene is the last in the scene order of its subsection).

No Previous Scene
mTropolis sends a No Previous Scene message to the shared scene, its elements and modifiers when a scene begins and that scene has no scenes before it (i.e., the scene is the first in the scene order of its subsection).

Hot Tip
No Next Scene and No Previous Scene can be used to show and hide scene navigation buttons located in the shared scene.

PROJECT MESSAGES

Choose Project in the When pop-up or the Message/Command pop-up to reveal the submenu options described below (Figure 13.11).

How mTropolis Handles Project Messages and Commands
Project messages and commands relate to an entire project:

- The *Close Project* command can be sent to the project to quit a mTropolis project in runtime.
- The User Timeout message is generated when there has been no user activity for a specified time. The timeout duration can be changed using the *Set Attribute* command (see "Get and Set Attribute Commands" on page 13.246).
- The Project Started and Project Ended messages are sent to the project component when a project begins or ends.
- The *Flush All Media* command can be sent to the project to globally remove media from memory.

Using Project Messages with the When Pop-Up
Select a project message in a When menu to activate or deactivate the modifier when the message is received, either from mTropolis or from a messenger.

Using Project Messages with the Message/Command Pop-Up
Select a project message in a Message/Command menu to send the message to a

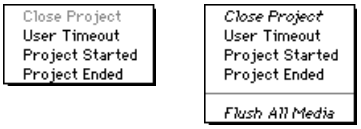


Figure 13.11 Project messages in the When and Message/Command pop-up menus

targeted destination just as if the mTropolis environment had generated the message.

Close Project (Message/Command Menu Only)
Send the *Close Project* command to the project to quit a mTropolis runtime project.

User Timeout
mTropolis sends a User Timeout message to the shared scene and the active scene, as well as all of their elements and modifiers when there have been no user actions for a specified time. The timeout duration can be changed using the *Set Attribute* command or Miniscript to change the value of the userTimeout attribute (see "Get and Set Attribute Commands" on page 13.246 and "userTimeout" on page 15.293).

Project Started
mTropolis sends a Project Started message to the project component, and all of its modifiers, when the project starts. This message does not cascade any further through the project.

Project Ended
mTropolis sends a Project Ended message to the project component, and all of its modifiers, when the project ends (e.g., when the user quits the title). This message does not cascade any further through the project.

Flush All Media (Message/Command Menu Only)
Send the *Flush All Media* command to the project to remove all loaded media from memory. Sent by itself, this command causes all media currently loaded to be unloaded from memory. This command can be sent with an accompanying integer that represents a flushPriority value. When sent with an accompanying value, media are flushed only if their element's flushPriority attribute is less than or equal to the accompanying value. For more information, see "flushPriority" on page 15.283.

GET AND SET ATTRIBUTE COMMANDS

Choose Get Attribute or Set Attribute in the Message/Command pop-up to reveal the submenu options described below. All of these options are commands; they are not available in the When menu. Commands are not sent by mTropolis, they can only be sent from messengers.

Element Attributes

Every element in a project has inherent attributes that allow the element or its linked media to be controlled and modified. Many attributes are accessible via the *Get Attribute* and *Set Attribute* commands listed in the Message/Command pop-up. Note that the Miniscript modifier can also be used to get and set attributes, including advanced attributes that cannot be selected from the Message/Command menu. See "Setting Values of Element Attributes" on page 14.262.

The items listed in the Get Attributes and Set Attributes submenus vary according to the media type associated with the element on which the messenger is placed. For example, a messenger placed on a PICT has access to the

graphic element attributes such as height, width, position and layer order number.

Using the Get Attribute Command

To retrieve the current value of an attribute, select one of the *Get Attribute* commands from the Get Attribute submenu. The "With" pop-up menu must be used to select a variable in which to store the attribute's value. When the element receives the selected *Get Attribute* command, the selected variable is set to the attribute's value. Note that the variable must be of the same data type as the attribute being retrieved (e.g., the *Set range* command must be accompanied by an integer range variable). The data types of attributes are listed in the descriptions of individual attributes (see "Attribute Descriptions" on page 15.276).

Using the Set Attribute Command

To set the value of an attribute, select one of the *Set Attribute* commands from the Set Attribute submenu. These commands require the new value of the attribute to be sent with the command. This value must be of the same data type as the attribute being set. For example, the *Set width* command requires an integer value, representing pixels, to be used as the new element width. Use the "With" pop-up menu (see "The "With" Pop-Up Menu" on page 13.248) to specify the value to be sent. The data types of attributes are listed in the descriptions of individual attributes (see "Attribute Descriptions" on page 15.276).

The *Get Attribute* and *Set Attribute* commands can also be used in more complex operations. For example, these commands can be used with variables to store and retrieve the attributes of elements that change over time. For example, a messenger on a draggable element can be configured to get its position when it receives a Scene Started message. The position of the element can be stored in a point variable, and later accessed by a second messenger that is configured to reset the element's position upon receipt of a Scene Ended message. During runtime, regardless of where the user has dragged the element, it will be returned to its original location when the scene ends.

Get and Set Attribute Option Descriptions

The following Get Attribute and Set Attribute options are available in the Message/ Command menu. Note that different options are available depending on the type of media associated with the element being modified by the messenger.

The figures below show the Get Attribute submenu options that are available for graphic elements (e.g., PICTs), text elements, video elements (e.g., QuickTime), mToons, sound elements, and projects. The Set Attribute submenu options are identical to the options shown below, except that the word "Set" replaces the word "Get" in the command name.

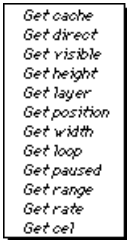
Information on individual attributes can be found in "Attribute Descriptions" on page 15.276.

Get/Set Attribute Options by Media Type

These options are available for graphic elements such as PICTs:

These options are available for text elements:

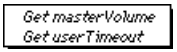
These options are available for mToons:



These options are available for QuickTime movies:

These options are available for sound elements:

The following options are available when a messenger is attached to the project component itself. Such a modifier can only be placed in the structure view:



THE "WITH" POP-UP MENU

Use the With pop-up menu to select a value to be sent with the message or command selected in the Message/Command menu.

The choices on this pop-up are None, Incoming Data and any variables to which the element has access. A data value can be sent by highlighting the With text field and typing in a value. These menu items are described in more detail below:

- **None**: This is the default selection. No value is sent with the message.
- **Incoming Data**: Choose this option to configure the messenger to send the incoming data (i.e., the value that arrives with the message that has been configured to trigger the messenger), with the outgoing message or command.
- **Variables**: To send the value of a variable modifier with the outgoing message, select its name from the submenus available in the second section of the With pop-up menu.

All variable modifiers currently available to a messenger from its position in the project's hierarchy are shown. These variable modifiers are only be accessible to those modifiers or Miniscripts in its "scope." See "Variable Scopes" on page 13.253.

- **Constant Data Value**: To send a constant data value, highlight the With text field and type the value to be sent. The value should be entered with the same syntax as if it were being used in a Miniscript modifier. The syntax of the expression entered is checked when OK is clicked. Any appropriate mTropolis data type can be sent.

THE DESTINATION POP-UP MENU

Use the Destination pop-up menu to select a destination for the message or command selected in the Message/Command menu.

The default for this menu is "Element", meaning that the message or command is sent to the element on which the messenger is placed. The destination can be changed by selecting a new option from the menu (Figure 13.12).

Destinations can be chosen by name or by relative position in the project hierarchy. The ability to target a relative rather than an absolute destination for a message allows the elements of a project to be changed without having to reconfigure the messengers that

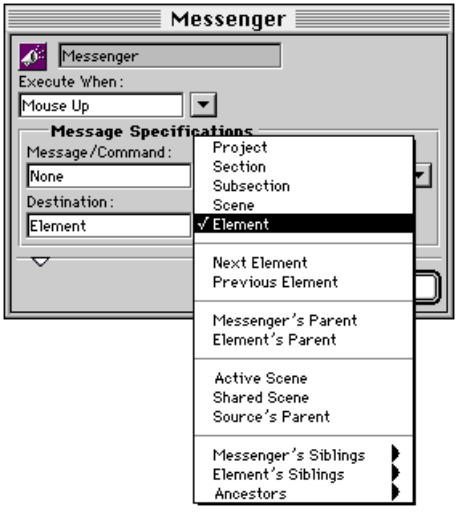


Figure 13.12 Typical messenger dialog with Destination menu

target them. This feature is particularly useful when the components of a project are to be used in other projects. More information about hierarchical relationships between elements can be found in "Message Passing among Elements" on page 8.86.

Destination Option Descriptions

Choose an item from the Destination pop-up to indicate where in the project the message or command is to be sent. Note that, by default, messages are sent not only to the targeted destination, but also to all the components within the targeted destination (i.e., they "cascade" and "relay"). This behavior can be changed using the Message Options section of the messenger dialog (see "Message Options" on page 13.252 or page 12.128).

Destination options are described below. Note that only the default behavior of the message is described (i.e., messages are assumed to be set to "cascade" from one level of the hierarchy to another and to "relay" from one modifier to another).

Project

The project destination refers to the topmost structural level of the mTropolis hierarchy. The project component and *every* component contained within the project (i.e., all sections, subsections, scenes, and components of those scenes) receives the message. Although possible, sending a Mouse Up, or equally common message, to a section is not recommended. The system will run more efficiently if this type of message is configured to be sent directly to the element to be affected.

- *Note: Use the structure view to see or place modifiers at the project level.*

Section

The section destination refers to the section in which the messenger resides. The section component and every item contained in the section (i.e., all subsections, scenes, and components of those scenes) receives the message. Although possible, sending a Mouse Up, or equally common message, to a section is not recommended. The system will run more efficiently if this type of message is configured to be sent directly to the element to be affected.

- *Note: Use the structure view to see or place modifiers at the section level.*

Subsection

The subsection destination refers to the subsection in which the messenger resides. The subsection component and every item contained in the subsection (i.e., all scenes and components of those scenes) receives the message.

- *Note: Use the structure view to see or place modifiers at the subsection level.*

Scene

The scene destination refers to the scene of which the messenger is a part. Directing a message to a scene results in all elements on the scene receiving the message, including the scene itself. This destination is useful when

multiple elements in a scene need to be sent the same message.

Element
Element is the default selection. The message or command is sent to the element that contains the messenger. All modifiers on the element receive the message. The message then cascades to any child elements.

Next Element
Choose Next Element to send a message or command to the next sibling of the element associated with the messenger (i.e., the next element in the messaging order of elements in a component).

Previous Element
Choose Previous Element to send a message or command to the previous sibling of the element associated with the messenger (i.e., the previous element in the messaging order of elements in a component).

Messenger's Parent
The parent of the messenger receives the message or command. The parent of a messenger is its "container", whether that container is an element or behavior.

Element's Parent
The parent of the element associated with the messenger receives the message or command.

Active Scene
Choose Active Scene to send a message to the scene visible to the user when the message is sent. By default, all elements and their modifiers on the active scene, as well as the active scene and its modifiers receive the message.

Shared Scene
Choose Shared Scene to send a message to all elements and their modifiers on the shared scene, as well as the shared scene and its modifiers. For additional information regarding shared scenes, see "Shared Scenes" on page 10.96.

Source's Parent
The source's parent is the parent of the messenger that sent the message that activated the current messenger. This destination is invalid if the messenger is configured to respond to an environment message sent by mTropolis.

Messenger's Siblings
The names of the messenger's siblings appear on the Messenger's Siblings submenu. Target any one of these modifiers by choosing its name from this list.

Element's Siblings
The names of the siblings of the element associated with the messenger appear on the Element's Siblings submenu. Target any one of these elements directly by choosing its name from this list.

Ancestors
The names of all ancestors of the messenger (that is, parents further up the structure hierarchy) appear in the Ancestors submenu. Target any of these destinations directly by choosing its name from this list.

MESSAGE PATHS

By default, messages sent from messengers are sent to their target destination and then they continue down through the child components

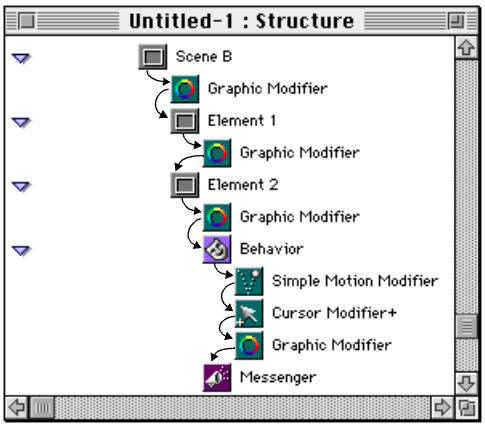


Figure 13.13 Messaging order. The arrows show the path of a cascading and relaying message sent to Scene B.

that destination contains. In this way, a single message can be used to activate many modifiers in components throughout a project.

Figure 13.13 shows a sample scene as it would appear in the structure window. Each element in this window appears on its own level, in a hierarchy from left to right. The descending order of modifiers and components within these components is called their "messaging order." The arrows trace the default path of a message targeted to Scene B. Notice how the message descends each level of the structure hierarchy and that the message could be activating any of the modifiers in the scene.

A message is said to "Cascade" if it travels through the structure hierarchy from component to component, structure level to structure level. A message is said to "Relay" if it continues from modifier to modifier, activating as many modifiers as possible. This path is the default for messages sent from a messenger.

For example, in Figure 13.13, when Scene B receives the message it is relayed to its graphic modifier. From there the message "cascades" to Element 1, the next level in the structure hierarchy. The element then relays the message to Element 1's graphic modifier. The message cascades once again to the next component in the scene, Element 2. The message is then relayed from Element 2 to every remaining modifier in the scene. When the last item in the scene has received the message, its path is complete.

The default path of messages sent by messengers can be changed as described in "Message Options" on page 13.252.

Default Path of Messages Sent by the mTropolis Environment

Note that the path of messages sent to elements from the mTropolis environment (e.g., user mouse click messages) is slightly different than the default for messages sent by messengers. mTropolis-sent environment messages do not cascade, but they do relay. In other words, the message is sent to the target element, activates any modifiers on that element that are set to respond to the message, and then stops.

Message Options

All messenger dialogs have a Message Options section that can be revealed by clicking the

triangle at the bottom of the dialog. This dialog can be used to more precisely target and time messages sent from a messenger.

Options in this section are:

Cascade Checkbox
By default, the message "cascades" from the targeted destination to all components in the hierarchy below it. Uncheck this option to configure the messenger to send its message only to the modifiers in a targeted element. "Cascade off" is equivalent to the path of an environment message sent by mTropolis.

- *Note: This option has no effect when sending a command. Commands act only on the targeted element.*

Immediate Checkbox
By default, messages or commands are sent immediately when the messenger is activated. Uncheck this box to configure the messenger to send its message or command only after the current thread of messages has ended. This option can be used to avoid system overload if the message thread queue becomes too deep.

Relay Checkbox
By default, messages travel from element to element in the hierarchy activating any and all elements that respond to the message. Uncheck this box to activate only the *first* modifier in the path of the message that is configured to respond. In effect, the first modifier to respond to the message "swallows" the message.

- *Note: This option has no effect when sending a command. Commands act only on the targeted element.*

VARIABLE SCOPES

Variable modifiers (variables) can be selected from the With menu (see "The "With" Pop-Up Menu" on page 13.248) and referenced in the text of Miniscript modifiers, if the messenger or Miniscript modifier exists in the variable's *scope*. That is, a variable modifier's scope determines which modifiers can "see" and make use of that variable modifier.

The scope of the variable is determined by its position in the project's structural hierarchy. A variable is accessible to all descendants of its parent.

Illustrating Variable Modifier Scopes

A variable can be accessed by any descendant of the variable's parent. For example, a variable modifier placed on a section is available to any modifier within that section, and all the section's "descendants". An element's descendants include any objects found anywhere "under" it in the hierarchy, no matter how many layers deep.

A variable modifier whose parent is the project (such as Variable Modifier 1 in Figure 13.14) is said to be *global*. Since all components of a project are its descendants, any variable placed at the project level can be accessed by any appropriate modifier in the entire project.

For example, an integer variable modifier that keeps track of the user's current score would probably need to be updated by many different modifiers throughout the title. Placing the variable on the project ensures that any modifier that may use the variable has access to it.

To create a global variable:

- Use the structure view to display the project's hierarchy.
- Drag a variable modifier from its palette and drop it on the project icon (the topmost icon in the structure hierarchy). For more information on using the structure window, see "Adding Components to a Project in the Structure Window" on page 8.84.

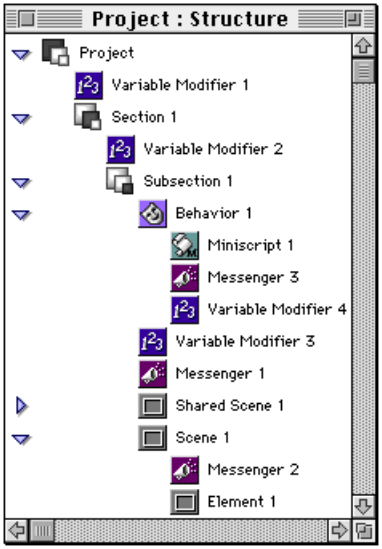


Figure 13.14 Variable scopes

For a more localized scope, variable modifiers can be placed in specific components anywhere in the project.

Figure 13.14 shows a number of variables with *local* scopes. For example, following the scoping rule, Messenger 1, Messenger 2 and Miniscript 1 shown in the figure have access to the following variable modifiers:

- Messenger 1 could access Variable Modifier 1, Variable Modifier 2, and Variable Modifier 3.
- Messenger 2 could access Variable Modifier 1, Variable Modifier 2, and Variable Modifier 3.
- Miniscript 1 could access Variable Modifier 1, Variable Modifier 2 and Variable Modifier 4.

To summarize, a variable modifier can be used by any modifier that:

- Makes use of variable modifiers (e.g., messengers, Miniscript), and
- Is a descendant of the variable modifier's parent (i.e., it is within the variable modifier's scope).

Variable Persistence

When testing a project, keep in mind that variables will behave differently depending upon whether the **Run-Player Emulation** menu toggle (found in the File menu) is checked or unchecked.

When the **Player Emulation** toggle is checked (the default), variables at the scene

level of the structural hierarchy and lower revert to their original values upon returning to edit mode. Variables located higher than the scene level (e.g., in the Subsection, Section, and Project components) retain any changes that are made to them during runtime mode.

When the **Player Emulation** toggle is *unchecked,* the values of all variables are persistent between runtime and edit mode.That is, when a variable's value is changed in runtime mode, the value remains changed upon returning to edit mode.

Persistence of Variables between Scene Changes in Built Titles

In a built title, variables return to their "original" values (i.e., the values they had when the title was built) *whenever the scene in which they reside is loaded.* This behavior can be confusing as variables behave differently in the mTropolis editing environment depending upon the current **Player Emulation** setting.

Consider a scene that contains an integer variable named "myInt". myInt is configured to have an original value of 3. Suppose that some user mouse event causes the variable's value to be changed to 5. Now suppose that a scene change occurs (e.g., the user navigates to the next scene) and then, sometime later, the original scene is returned to. The value of myInt will be different depending upon how the project is being run:

- If the project is being run in the mTropolis editor with **Player Emulation** *unchecked,* the value of myInt will still be 5 upon returning to the original scene. The value stays the same because, in this runtime mode, scenes are only loaded once. They are not unloaded from memory when the scene is changed nor are they reloaded when a scene is displayed multiple times.
- If the project is being run in the mTropolis editor with **Player Emulation** *checked* (the default), or if the project is made into a built title and run by the mTropolis player, myInt will contain 3 upon returning to the original scene. The value is reset to 3 because the original scene is unloaded from memory when the scene changes and then reloaded into memory upon returning to the original scene. Variables are reset to their original values whenever the scene in which the reside in loaded.

This discrepancy can cause confusion when authoring complex titles. Note also that there are two techniques that can be used to make variables persistent across scene changes:

- Use the **Object - Make Alias** menu option to alias variables in a scene that need to retain their values between scene changes. Aliased variables are not unloaded from memory between scene changes and, hence, will be persistent.
- Put variables that need to retain their values across scenes into the subsection, section, or project components. Recall that variables at the project level are considered global.

Variable Scopes

Chapter 14. Miniscript Modifier

The Miniscript modifier can be used to access mTropolis' built-in scripting language. Miniscript is a simple scripting language that can be used to:

- Access and change element attributes, such as the screen position of elements.
- Perform mathematical operations.
- Get and set the value of variable modifiers that lie within the scope of the Miniscript modifier.
- Perform comparisons and conditional branching using relational operators and "if" statements.
- Send multiple messages and/or commands to components of a project.

This chapter describes Miniscript syntax, statements, operators, and miscellaneous functions.

- *Note: Miniscript expressions can also be used in the "If" messenger (page 12.154).*

THE MINISCRIPT MODIFIER DIALOG

Miniscript modifiers can be added to elements (and behaviors) just like any other modifier. Simply drag the Miniscript modifier from the modifier palette and drop it on the element to be modified. Double-click the Miniscript modifier on an element to display its dialog.

Figure 14.1 shows a Miniscript modifier dialog with a single-line script entered into it. Components of the Miniscript modifier dialog are described below.

Editable Name Text Box
Like all other mTropolis modifier dialogs, the Miniscript dialog has a text entry field that can be used to give the modifier a unique and descriptive name.

Execute When Pop-Up Menu
Use this pop-up menu to select the message that triggers the modifier. When this message is received, the Miniscript commands in the "Script" text box are executed.

Script Text Box
Use the Script text box to edit the script associated with the modifier. Scripts can have a maximum of 32,768 characters in them. By default, this field is blank. Figure 14.1 shows a simple script that changes the value of a floating-point variable modifier ("myFloat") to 4.555.

OK Button
The script is checked for syntax and then compiled when the OK button is clicked. If mTropolis detects any syntax or other errors during compilation, the error is flagged and the compilation process is aborted. A flashing text cursor is placed in front of the offending statement and an alert dialog appears, describing the error.

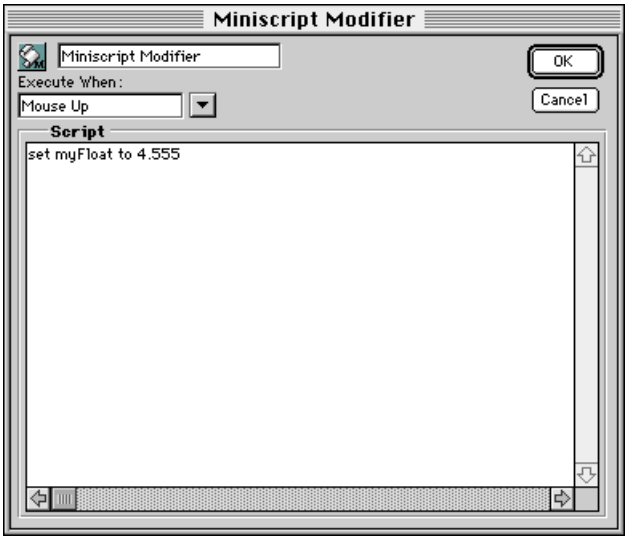


Figure 14.1 The Miniscript modifier dialog

BASIC MINISCRIPT SYNTAX

Miniscript uses a "natural language" syntax that makes the scripting language quick and easy to learn. Writing a script involves using a combination of reserved words, variable names, component names, and literal values (numbers, strings, etc.). An example is the script:

```
set myFloat to 4.555
```

"myFloat" refers to an existing floating-point variable modifier. The literal value 4.555 is the value that the variable modifier will assume.

Basic rules of Miniscript syntax are described below.

Comments

Any text following two dashes (`--`) is considered to be a comment, and is ignored when the script is compiled. Use comments to annotate and clarify scripts. In the following example, the first line is a comment:

```
-- Add two to myFloat:
set myFloat to myFloat+2.0
```

In the next example, the text "-- Initialize X" is a comment:

```
set x to 5 -- Initialize X
```

Case Sensitivity

Miniscript is *not* case sensitive. Miniscript statements can be written in uppercase, lowercase, or mixed case. In this manual, most statements and keywords are written in

lowercase. To improve readability, element and variable names are sometimes written in mixed case (e.g., `myFloat`). However, since variable names are not case sensitive, the names `myfloat` and `MyFloat` are interpreted as the same by Miniscript.

Note that the text of string values is also case insensitive. When performing comparisons between strings, an uppercase string such as `"MY TEXT"` is equivalent to the lowercase string `"my text"`.

Continuation Character

Each line of a script is a complete command terminated by a return character. To write a single command as a number of lines, add a backslash character ("\") to the end of each continued line. For example, the following two lines are a single Miniscript command:

```
send "myAuthorMessage" with myFloat \
      to element's parent
```

Note that in the second line shown above, the leading spaces are ignored by Miniscript; the line does not have to be indented. Spaces and tabs can be used to improve the readability of scripts.

Variables

The values of variables in a mTropolis project can be accessed and set using Miniscript. mTropolis supports two types of variables: *simple* variables and *compound* variables. Simple variables contain a single value. Simple variables include the boolean, floating-point, integer, and string variable types. Compound variables contain multiple *fields* that each contain separate values. Compound variables include the integer range, list, point, and vector variable types. See Chapter 12, "Modifier Reference", for descriptions of the individual variable modifiers.

Using Variable Names in Scripts

Most variables can be referenced in a script by simply using the variable's name (as set in the variable modifier's editable name text box). The only exceptions are variable names that contain periods and/or spaces. If a variable name contains these characters, the name must be enclosed in single quotes when used in a script. For example, an integer variable with the name `myInt` could be referenced in a script as follows:

```
set myInt to 5
```

However, a variable with a name such as `my Wonderful Integer` must be enclosed in single quotes as shown below:

```
set 'my Wonderful Integer' to 5
```

Note that variables should be created *before* their names are referenced in a script. Writing Miniscript statements that use variable names that have not yet been created can lead to unpredictable results. Also, keep in mind that variables can only be used in a script if they are within the Miniscript modifier's scope. See "Variable Scopes" on page 13.253.

Variable and Component Naming

Variables should be given unique names (i.e., names that are not used by other components in the project) to ensure that Miniscript references to those variables resolve to the

variable and not to some other component. For example, if a variable is given the same name as a Miniscript modifier that attempts to access that variable, an object reference to the Miniscript modifier might be returned instead of the variable's value.

Accessing the Fields of Compound Variables

The fields of compound variables can be referenced by using a period followed by the name of the field. For example, the following command sets the "start" value of an integer range variable to 4:

```
set myIntegerRange.start to 4
```

The fields in each type of compound variable are listed in the descriptions of each variable modifier found in Chapter 12, "Modifier Reference". They are also described in "Setting the Value of Compound Variables" on page 14.262

Note that the syntax is the same for accessing the user-created fields of custom "compound variables" created with the compound variable modifier (see "Compound Variable" on page 12.144).

Literal Values

Literal values for most mTropolis data types can be used in scripts. Each mTropolis data type has a different syntax as shown in Table 14.1.

Data Type	Syntax	Examples
boolean	**`true`** or **`false`**	`true` `false`
floating-point	*`n.n`*	`1.0` `60.547`
integer	*`n`*	`5` `50`
integer range	**`(`***n_{start}* **`thru`** *n_{end}***`)`** parentheses are optional	`(1 thru 10)` `(0 thru 99)`
list	**`{`***n_1, n_2, ..., n_{last}***`}`** items in a list can have any data type except list	`{10, 15, 30}` `{"dog", "cat", "bird"}`

object reference	Special: See Table 14.2, "Building blocks for targeting project components in Miniscript expressions.," on page 265	`element`
		`element.parent`
		`scene.myPict`

point	**`(`***n_x,n_y***`)`** parentheses are optional	`(0,0)` `(240,320)`
string	**`"`***`text`***`"`**	`"mFactory"`
vector	**`(`***n_{angle}*`°` *`n.`**$n_{magnitude}$***`)`** the degrees symbol can be typed by pressing Shift-Option-8 on Macintosh	`(90° 1.0)` `(63° 2.5)`

Table 14.1: Miniscript Syntax for Literal Values. An "n" in the table indicates a numeral.

Element Names

Elements can be the targets of messages sent by Miniscript statements. Additionally, most components in a mTropolis project have attributes whose values can be retrieved or modified using Miniscript.

Most elements can be referenced in a script by simply using the element's name (as set in the element's Element Info dialog). The only exceptions are element names that contain periods and/or spaces. If an element name contains these characters, the name must be enclosed in single quotes when used in a script (e.g., `'my Element'`).

To be referred to by name, an element must be within the Miniscript modifier's scope. See "Specifying the Destination for a Message" on page 14.264 for more information.

Element *attributes* (see Chapter 15, "Attributes") can be referenced using a syntax similar to that used to reference the fields of compound variables. Add a period, followed by the attribute's name, to the element name. For example, the following command sets the "width" of an element:

```
set myElement.width to 120
```

Complete descriptions of mTropolis component attributes can be found in Chapter 15, "Attributes".

Message and Command Names

Messages and commands can be sent to elements using the **send** statement. Message or command names must be enclosed in double quotation marks. For example:

```
send "myAuthorMessage" to element
```

Names of built-in messages and commands can be found in Chapter 13, "Modifier Pop-Up Menus and Message Reference".

SET—THE MINISCRIPT ASSIGNMENT STATEMENT

The Miniscript **set** statement can be used to change the values of variables or element attributes. It is Miniscript's version of an assignment operator. The basic form of this statement is:

```
set variable to value
```

where *variable* is the name of a variable or element attribute to be set and *value* is an expression of the proper type for *variable*.

Setting Values of Variable Modifiers

Variable modifiers give elements the ability to store many different types of data. Miniscript can be used to alter these values.

The **set** statement can be used to modify the values of both simple and compound variable types.

Setting the Value of Simple Variables

Setting the value of a simple variable is easy. The following examples show the syntax used to set each type of simple variable:

- Boolean variable:

  ```
  set myBoolean to true
  ```

- Floating-point variable:

  ```
  set myFloat to 4.555666
  ```

- Integer variable:

```
set myInteger to 888
```

- String variable:

```
set myString to "mFactory"
```

Setting the Value of Compound Variables

The fields of compound variable modifiers can be set individually or together as a group. To set the value of a field individually, use the syntax:

```
set variable.field to value
```

where *variable* is the name of the compound variable, *field* is the name of the field to be set and *value* is an expression of the proper type for *field*. Alternatively, the following syntax can be used for a more "natural language" style:

```
set the field of variable to value
```

The following examples show the syntax used to set various types of compound variables:

- Integer range variables have start and end fields. To set the start field individually:

  ```
  set myIntegerRange.start to 4
  ```

  To set the end field individually:

  ```
  set myIntegerRange.end to 9
  ```

  To set both fields:

  ```
  set myIntegerRange to (4 thru 9)
  ```

- List variables can store any number of values that are accessed with a slightly different syntax than most other variables. See "Miniscript Syntax for List Variables" on page 12.163.

- Point variables have an x and a y field. To set the x field individually:

  ```
  set myPoint.x to 15
  ```

  To set the y field individually:

  ```
  set myPoint.y to 30
  ```

  To set both fields:

  ```
  set myPoint to (15,30)
  ```

- Vector variables have an angle and a magnitude field. To set the angle field individually:

  ```
  set myVector.angle to 45
  ```

  To set the magnitude field individually:

  ```
  set myVector.magnitude to 1.41
  ```

  To set both fields:

  ```
  set myVector to (45°1.41)
  ```

- *Note: The ° symbol ("degrees") can be typed by pressing Shift-Option-8 on Macintosh.*

- User-created compound variables, made with the Compound Variable modifier, can have any number of user-defined fields. See "Compound Variable" on page 12.144 for complete documentation and examples.

Setting Values of Element Attributes

Element attributes can be set with a syntax similar to that used to set the values of compound variable fields. To set the value of an attribute, use the syntax:

```
set element.attribute to value
```

where *element* is the name of the element, *attribute* is the name of the attribute to be set

and *value* is an expression of the proper type for *attribute*. Alternatively, the following syntax can be used for a more "natural language" style:

```
set the attribute of element to value
```

Note that in the statements above, the word "element" is optional since **set** assumes that the script is referencing its own element's fields unless otherwise specified. Therefore, the statements above are equally valid written as:

```
set attribute to value
```

Some element's attributes have multiple fields, such as the position attribute, which accepts a point value. To access the fields of a compound value, simply add another period and the name of the field. For example, to set the "x" component of an element's "position" attribute, use the statement:

```
set element.position.x to value
```

Descriptions of Element Attributes

For lists of element attributes and their descriptions, see "Attribute Descriptions" on page 15.276.

Setting Variables and Attributes to Incoming Values

Messages are often sent with an accompanying data value. The keyword **incoming** can be used with the **set** command to access data sent with the message that activates the Miniscript modifier. For example:

```
set myFloat to incoming
set myToon.width to incoming.x
```

The incoming data value could also be set to some new value. For example:

```
set incoming to myFloat
```

Note that incoming data can be of any type. If a **set** operation is attempted between items with different types, the value of the set "target" does not change and an error message may be generated.

THE SEND STATEMENT—SENDING MESSAGES AND COMMANDS

The **send** statement can be used to send environment messages, author messages, or commands from a script. Any number of messages can be sent from a single script, eliminating the need for multiple messengers. Any message or command described in Chapter 13, "Modifier Pop-Up Menus and Message Reference", can be sent with the **send** statement.

Basic Use of Send

The most simple form of the **send** statement sends a message to the element to which the script is attached:

```
send "Message"
```

The message or command enclosed in double quotes is sent to the element that contains the Miniscript modifier. Note that even if the Miniscript modifier is located inside a behavior, the message is still sent to the element that the behavior is associated with.

See Chapter 13, "Modifier Pop-Up Menus and Message Reference", for the names and

descriptions of messages and commands that can be sent.

Specifying the Destination for a Message

Messages or commands can be sent to destinations other than the element to which the script is attached. Use the **to** keyword as shown below:

```
send "Message" to destination
```

where *destination* is an explicit or relative destination described by using the building blocks shown in Table 14.2. Expressions created from these building blocks are expressions of "object reference" type.

For example, to send the author message **myMessage** to the parent of the element to which the script is attached, use the statement:

```
send "myMessage" to element.parent
```

To send the same message to an element that is a sibling or ancestor of the element, simply use the name of the destination element. For example:

```
send "myMessage" to Frog
```

The destination can be any expression, composed of the building blocks shown in Table 14.2, that resolves to an object. For example:

```
send "Msg" to source.parent.parent
```

sends the specified message to the parent of the parent of the messenger that triggered the Miniscript modifier. Note that, as with attributes and compound variables, you can use the "dot" syntax shown above or the "natural language" syntax. For example, the previous send statement could also be written as:

```
send "Msg" to source's parent's parent
```

Sending Values with Messages

A value can also be sent along with the message or command using the **with** keyword:

```
send "Msg" with value to destination
```

where *value* is an expression of the appropriate type to accompany the message or command sent. For example:

```
send "Scroll Up" with 5
send "MoveFrog" with myPoint
send "Play" with myRange to myToon
send "Mouse Up" with (100,100) to next
```

The **incoming** keyword can also to used to access data that was received by the Miniscript modifier. For example:

```
send "New Left Edge" with incoming \
    to parent
```

If **incoming** contains a compound value, its fields can be accessed using the standard syntax:

```
send "add Value" with \
  incoming.magnitude to scene
```

Changing the Message Options

Just like messages sent from messengers, messages sent with the **send** statement can be sent with special options. By default, messages are set to "cascade", "relay", and are sent immediately. See "Message Options" on

Destination	Syntax
Project	`project`
Section	`section`
Subsection	`subsection`
Scene	`scene`
Element	`element` (or simply omit as element is the default destination)

Element's parent	`element.parent`
	or
	`element's parent`

Miniscript modifier (i.e., the modifier that contains script being executed)	`this`
Miniscript modifier's parent	`parent`

Source's parent
(The *source* is the modifier that generated the message that triggered the Miniscript modifier.)
	`source.parent`
	or
	`source's parent`

Active scene	`activeScene`
Shared scene	`sharedScene`

Next element	`element.next`
	or
	`element's next`

Next modifier (either on the same element or in the same behavior that contains the Miniscript modifier)	`next`

Previous element	`element.previous`
	or
	`element's previous`

Previous modifier (either on the same element or in the same behavior that contains the Miniscript modifier)	`previous`
Element's sibling or ancestor (an ancestor is a component located *above* the element in the structural hierarchy)	*`elementname`* (i.e., use the actual name of the element's sibling or ancestor)
Element's immediate child (a child just *one* level below the element in the structural hierarchy)	*`elementname`* (i.e., use the actual name of the element's immediate child. Note that children more than one level below the element cannot be targeted by name alone, due to scoping rules.)

Table 14.2: Building blocks for targeting project components in Miniscript expressions.

page 13.252 for more information on these options and message passing in general.

The **options** keyword can be used to change the default behavior of the message sent by a **send** statement. The **options** keyword must be followed by one or more option selections. Valid selections are **cascade**, **relay**, **immediate**, **all**, and **none**. The **options** keyword can also be shortened to **opt**.

The default option is **all**, meaning that the message will cascade, relay, and be sent immediately. When a single option is specified, the remaining options are turned off. The **none** option can be used to turn all options off.

For example, to send a message with all options turned off:

```
send "myMsg" to parent options none
```

To send a message that only cascades:

```
send "myMsg" to element \
    options cascade
```

To send a message that cascades and relays, but is not immediate:

```
send "myMsg" to scene opt \
    cascade relay
```

THE IF STATEMENT—CONDITIONAL BRANCHES OF EXECUTION

The **if** statement can be used to evaluate an expression and take certain actions if that expression is true. The general syntax is:

```
if expression then statement
```

The Miniscript statement represented by *statement* will be executed if *expression* evaluates to true. For example, suppose variable a has the value 2 and variable b has the value 3 when the following **if** statement is executed:

```
if a<b then send "myMessage"
```

Because a is less than b, the message will be sent.

Multiple statements can be executed by using the syntax:

```
if expression then
statement1
...
statementn
end if
```

The **else if** and **else** keywords can be used to specify other conditions or statements that should be executed. Use the syntax:

```
if expression1 then
statements
else if expression2 then
statements
else if expressionn then
statements
else
statements
end if
```

Each expression is evaluated in order. If an expression is true, its corresponding statements are executed. Any following conditions are skipped and execution continues with the next Miniscript statement in the script. Statements associated with the **else** section are executed if no other condition is satisfied.

For example, the following script executes the first **set** statement if the angle field of myVector is greater than 30, otherwise, the second **set** statement is executed:

```
if myVector.angle > 30 then
set myVector.magnitude to rnd(25)
else
set myVector.magnitude to rnd(10)
end if
```

Definition of True

The expression evaluated by the **if** statement can be any type of expression. Usually, you want to evaluate a boolean expression (which simply evaluates to either true or false). However, other data types have "true" and "false" conditions. The definition of true or false for different data types is as follows:

- Boolean values are either true or false.
- Integer and floating-point: 0 is false, any other value is true.
- Strings and compound values: these values are always false.

MINISCRIPT OPERATORS

Operators are used to create expressions. The set of Miniscript operators is described below.

Parentheses ( )

Parentheses are used to group expressions and to override the natural order of operator evaluation—expressions in parentheses are always evaluated first. For example, in the statement:

```
set c to (a+b)/e
```

The expression (a+b) is evaluated first, then the result is divided by e.

See "Operator Precedence" on page 14.269 for information on the default order of operator evaluation.

Mathematical Operators

Miniscript supports the following mathematical operators, described in order of descending precedence.

Exponentiation (^)

The caret (^) is the exponentiation operator. A^B is equal to A raised to the B power.

Multiplication (*)

The asterisk (*) is the multiplication operator. For example, 2*5 evaluates to 10.

Division (/)

The forward slash (/) is the division operator. For example, 6/2 evaluates to 3.

Div (Integer Division)

The **div** operator performs a special "integer" type of division where any remainder is dropped. For example, 4.0 **div** 3.0 evaluates to 1.

Mod (Modulus)

The **mod** operator performs a modulus operation. It returns the remainder when the first operand is divided by the second operand. For example, 9 **mod** 5 evaluates to 4.

Addition (+)

The plus sign (+) is the addition operator. For example, 2 + 4 evaluates to 6.

Subtraction and Negation (-)

The minus sign (-) is the subtraction and negation operator. For example, `4 - 2` evaluates to 2. The statement `set c to -c` changes the sign of the value in variable c.

String Concatenation (&)

The string concatenation operator (&) can be used to combine the contents of strings. This operator accepts two string operands and returns a single string that consists of the first operand, followed by the second operand. For example, the statement:

```
"mTropolis" & " rules"
```

returns the single string:

```
"mTropolis rules"
```

Boolean Operators

Boolean operators return either true or false boolean values. Different variable types have different "true" and "false" states—see "Definition of True" on page 14.267 for more information.

And

The **`and`** operator returns true when both of its operands are true. For example, if boolean variable `a` contains true and boolean variable `b` contains true, the expression `a and b` evaluates to true.

Not

The **`not`** operator is the boolean inverse operator. It inverts the boolean value of its single operand. That is, the expression **`not true`** evaluates to false and the expression **`not false`** evaluates to true.

Or

The **`or`** operator returns true when either of its operands is true. For example, the expression `0 or 1` evaluates to true.

Relational Operators

Relational operators can be used to test the relationship between two values. They return true or false based upon the relationship of their operands.

Equal To (=)

The equal sign (=) is the relational "equal to" operator. It returns true if both its operands are equal, otherwise it returns false. For example, `2 = 4` returns false.

Greater Than (>)

The greater than operator (>) returns true if the first operand has a greater value than the second operand. For example, `4 > 2` returns true.

Greater Than or Equal To (>= or ≥)

The "greater than or equal to" operator (>= or ≥, which can be typed on Macintosh by pressing option-period) returns true if the first operand is greater than or equal to the second operand. For example, both `4 ≥ 3` and `3 ≥ 3` return true.

Less Than (<)

The less than operator (<) returns true if the first operand has a lesser value than the second operand. For example, `2 < 4` returns true.

Less Than or Equal To (<= or ≤)

The "less than or equal to" operator (<= or ≤, which can be typed on Macintosh by pressing

option-comma) returns true if the first operand is less than or equal to the second operand. For example, both `2 ≤ 3` and `3 ≤ 3` return true.

Not Equal To (<> or ≠)

The "not equal to" operator (<> or ≠, which can be typed on Macintosh by pressing option-=) returns true if its operands are not equal. For example, `3 ≠ 5` returns true.

Operator Precedence

Operators are evaluated in order of their precedence. Operators with a higher precedence are evaluated before those with a lower precedence. Operators with equal precedence are evaluated from left to right, as they appear in the expression. Table 14.3 shows the precedence of mTropolis' operators.

Precedence Level	Operators
1 (highest)	( ), expressions inside parentheses are evaluated first.
2	not
3	^
4	*, /, div, mod
5	+, -
6	>, >=, ≥, <, <=, ≤
7	=, <>, ≠
8	and
9 (lowest)	or

Table 14.3: Operator precedence

SPECIAL ENVIRONMENT VARIABLES

Two read-only environment variables (**`mouse`** and **`ticks`**), and one write-only environment variable (**`debug`**) can be referenced from within Miniscript.

The Mouse Variable

The **`mouse`** environment variable holds a point value that contains the current position of the mouse cursor. For example, to move an element's origin point to the current mouse position, use the statement:

```
set element.position to mouse
```

The Ticks Variable

The **`ticks`** environment variable holds an integer value that contains the number of time ticks (defined as 1/60 second) that have elapsed since boot time. For example, to obtain the number of seconds that have elapsed since boot time, use the statement:

```
set myFloat to ticks/60
```

The Debug Variable

Set the **`debug`** environment variable to an expression (of any data type) to display that data in the Message Log window. The Message Log window must be open and logging must be enabled for this feature to work. More information about message logging can be found in "Message Log Window" on page 7.73. For example, to display the string "Hello World" in the Message Log window, execute the script:

```
set debug to "Hello World"
```

The message is visible in the Message Log upon returning to edit mode from runtime mode.

This environment variable can also be used to check the values of variables or attributes. For example, to display the contents of the point variable `myPoint` in the Message Log, execute the script:

```
set debug to myPoint
```

MINISCRIPT FUNCTIONS

Miniscript contains a number of built-in functions for performing mathematical operations, data type conversions, and other common operations. Functions can be used anywhere an expression or value can be used. For example, the **cos** function calculates the cosine of the specified angle:

```
set myFloat to cos(30)
```

Functions can also be nested. For example:

```
set myFloat to cos(exp(rnd(45)))
```

mTropolis assumes all angles are expressed in degrees.

Functions are described in alphabetical order, below. Note that some functions have multiple names that can be used interchangeably. These functions are listed with their names separated by commas. For example, to return the arctangent of an angle, either the **atn** or **arctangent** function can be used.

abs

The abs function returns the absolute value of its argument. The abs function is useful for tracking element movement. Use it to convert coordinate differences (negative or positive) into distances (always positive).

Syntax
abs(*numericExpression*)

Example
```
set myDistance to \
abs(positionB.x - positionA.x)
```

See Also
"sgn" on page 14.273

atn, arctangent

The atn function returns the angle, in degrees, whose tangent is *numericExpression*. The returned value is an angle between -90 and +90 degrees.

Syntax
atn(*numericExpression*)

Example
```
set myvector.angle to atn(45)
```

See Also
"tan, tangent" on page 14.273

cos, cosine

The cos function returns the cosine of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
cos(*numericExpression*)

Example
```
set myvector.angle to cos(45)
```

See Also
"sin, sine" on page 14.273
"tan, tangent" on page 14.273

cosh

The cosh function returns the hyperbolic cosine of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
cosh(*numericExpression*)

Example
```
set myFloat to cosh(2.2222)
```

See Also
"cos, cosine" on page 14.270
"sinh" on page 14.273
"tanh" on page 14.274

exp

The exp function returns the value of e raised to the power of *numericExpression*, where e is the natural number 2.71828 (i.e., the "natural" exponential function). The return value is a floating-point number.

Many natural processes involve quantities that increase or decrease at a rate proportional to their size. For example, a culture of bacteria will grow at a rate proportional to its mass. The value of an investment bearing interest that is continually compounded will increase at a rate proportional to that value.

Syntax
exp(*numericExpression*)

Example
```
set mynumber to exp(999.999)
```

See Also
"ln" on page 14.271

ln

The ln function returns the natural logarithm, log to the base e, of *numericExpression* where e is the natural number 2.71828. The return value is a floating-point number.

Syntax
ln(*numericExpression*)

Example
```
set myFloat to ln(3.1111)
```

See Also
"exp" on page 14.271
"log" on page 14.271

log

The log function returns the logarithm to the base 10 of *numericExpression*. The return value is a floating-point number.

This function is useful in calculating the pH of solutions, in heat conduction as well as for financial calculations.

Syntax
log(*numericExpression*)

Example
```
set myFloat to log(100000)
```

See Also
"ln" on page 14.271

num2str, numToString

The num2str function converts a numeric value to its string equivalent.

Syntax
num2str(*numericExpression*)

Example
```
set mystring to num2str(2.67)
```

See Also
"str2num, stringToNum" on page 14.273

polar2rect

The polar2rect function converts polar coordinates (angle, radius) to rectangular coordinates (x,y). This function accepts an argument of vector type. The return value is of point type.

Syntax
polar2rect(*vector*)
polar2rect(*angle°radius*)

Example
```
set myPoint to polar2rect(myVector)
```

See Also
"rect2polar" on page 14.272

rect2polar

The rect2polar function converts rectangular coordinates (x,y) to polar coordinates (angle, radius). This function accepts an argument of point type. The return value is of vector type (angle, magnitude).

Syntax
rect2polar(*point*)
rect2polar(*x,y*)

Example
```
set myVector to rect2polar(myPoint)
```

See Also
"polar2rect" on page 14.272

round

The round function rounds the floating-point value *numericExpression* to the nearest whole number. The return value is of integer type.

Syntax
round(*numericExpression*)

Example
```
set myInteger to round(2.71828)
```

See Also
"trunc" on page 14.274

rnd, random

The rnd function returns a random value from 0 to the value specified by *numericExpression*-1. The return value is an integer. This function is useful for randomizing messages in game play and positions on a Scene.

Syntax
rnd(*numericExpression*)

Example
```
set mynumber to rnd(100)
```

sgn

The sgn function returns the sign of *numericExpression*. If the value of *numericExpression* is less than 0, the return value is -1. If the value of *numericExpression* is greater than 0, the return value is 1. If *numericExpression* equals 0, the return value is 0.

Syntax
sgn(*numericExpression*)

Example
```
set mynumber to sgn(tan(rnd(26)))
```

See Also
"abs" on page 14.270

sin, sine

The sin function returns the sine of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
sin(*numericExpression*)

Example
```
set myvector.angle to sin(45)
```

See Also
"cos, cosine" on page 14.270
"tan, tangent" on page 14.273

sinh

The sinh function returns the hyperbolic sine of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
sinh(*numericExpression*)

Example
```
set myFloat to sinh(3.2222)
```

See Also
"cosh" on page 14.271
"sin, sine" on page 14.273
"tanh" on page 14.274

sqrt

The sqrt function returns the square root of *numericExpression*. The return value is a floating-point number.

Syntax
sqrt(*numericExpression*)

Example
```
set mynumber to sqrt(999.999)
```

str2num, stringToNum

The str2num function converts a string value to a floating-point value.

Syntax
str2num(*stringExpression*)

Example
```
set mynumber to str2num("1.5")
```

See Also
"num2str, numToString" on page 14.272

tan, tangent

The tan function returns the tangent of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
tan(*numericExpression*)

Example
```
set myvector.angle to tan(45)
```

See Also
"cos, cosine" on page 14.270
"sin, sine" on page 14.273
"tanh" on page 14.274

tanh

The tanh function returns the hyperbolic tangent of *numericExpression*, which represents an angle measured in degrees. The return value is a floating-point number.

Syntax
tanh(*numericExpression*)

Example
```
set myFloat to tanh(3.2222)
```

See Also
"cosh" on page 14.271
"sinh" on page 14.273
"tan, tangent" on page 14.273

trunc

The trunc function truncates the floating-point value *numericExpression*. That is, any decimal portion is removed. The return value is of integer type.

Syntax
trunc(*numericExpression*)

Example
```
set myInteger to trunc(2.71828)
```

See Also
"round" on page 14.272

MINISCRIPT ERRORS

Various errors may occur during the execution of the script contained by a Miniscript modifier. The Message Log window displays error messages generated by Miniscript. Even if logging is not enabled, this window is automatically displayed when an error occurs during runtime. The text of the error message is displayed in the Message Log window.

- *Note: When an error occurs that causes an error message to be generated, execution of the script stops at the statement that caused the error. Statements after the offending statement are not executed.*

For more information on individual error messages, see "Error Messages" on page 7.75

RESERVED WORDS

All Miniscript statement keywords, function names, operators (described in the preceding sections of this chapter), and attribute names (described in Chapter 15, "Attributes") are "reserved" words. These words should not be used to name project components or variables. While it is possible to use these reserved words outside of Miniscript to name project components, it is strongly recommended they not be used so as to avoid confusion and possible syntax or logic errors when writing scripts.

Chapter 15. Attributes

Most components of a mTropolis project have *attributes* whose values can be retrieved and/or modified using Miniscript. Attributes contain values that describe the current state of a mTropolis component. For example, graphic elements have width, height, and position attributes (among others).

Some attributes are readable and can be used in Miniscript expressions. Others are writable and can be used as targets for Miniscript **`set`** statements. Changing the value of a writable attribute causes an immediate change in the element whose attribute was modified. For example, changing a graphic element's width attribute causes the width of the element to change to the newly-specified size.

Many of the more basic attributes can also be accessed through the Message/Command menu (see "Get and Set Attribute Option Descriptions" on page 13.247).

Attributes can be referenced using a syntax similar to that used to reference the fields of compound variables (see "Accessing the Fields of Compound Variables" on page 14.260).

Graphical elements, mToon elements, sound elements, text elements, QuickTime and QuickTime VR elements, the project component, scene components, and the "special" AssetManager, System, and WorldManager components have attributes that can be read and/or written.

This chapter describes individual attributes and the syntax used to retrieve and set the value of attributes using Miniscript.

ELEMENT ATTRIBUTE SYNTAX

In general, an element attribute can be specified by adding a period, followed by the attribute's name, to the element name. For example, the current width of the element named `myPict` could be set to the value contained in `myInt` using the statement:

```
set myPict.width to myInt
```

A slightly different syntax can be used to refer to the attributes of the element on which the Miniscript modifier resides. Instead of using the element's name, the element can be referred to as `element`. For example:

```
set element.width to myInt
```

Alternatively, the "`element.`" part can be omitted because the element on which the Miniscript modifier resides is the default "target" for both messages and attribute references. For example, the following statement is equivalent to the previous one:

```
set width to myInt
```

- *Note: There is one special exception to this syntax. The "parent" attribute, when specified*

without the "element." prefix, specifies the Miniscript modifier's parent (i.e., the element or behavior that contains that script).

Note also that the relative "building blocks" for specifying elements such as `next`, `previous`, and `parent` can be used to specify components whose attributes are to be read or set. See Table 14.2 on page 14.265.

Special Components with Attributes

In addition to the various media elements and structural components that have attributes, three special components—the AssetManager, WorldManager, and System components, which are not visible in any of mTropolis' editing views—also have attributes:

- The AssetManager is the component that controls media assets. Its attributes describe media assets that have been linked to the project.
- The WorldManager is the component that controls the execution of a project. Its attributes control global project options.
- The System is the component that controls the execution of all open mTropolis projects. Its attributes are mostly hardware related. For example, the `system.ejectCD` attribute can be used to open the computer's CD-ROM drive.

When addressing their attributes, these components (`AssetManager`, `WorldManager`, or `System`) must always be specified by name. These components have no "relative" relationship to any other component in a mTropolis project.

For example, the following Miniscript statement sets the value of the WorldManager's "allowQuitKey" attribute:

```
set WorldManager.allowQuitKey to true
```

ATTRIBUTE DESCRIPTIONS

Individual attributes are described in alphabetical order, below. For attributes arranged by the type of mTropolis component they belong to, see "Lists of Attributes by Component Type" on page 15.295.

In addition to a description, the attribute's data type and whether the element is readable or writable is noted. *Readable* attributes can be used in Miniscript expressions. For these attributes, using the syntax *component.attribute* in a script returns the current value of *attribute* (which has the data type listed for the attribute) for the specified *component*. *Writable* attributes can be changed by using the **`set`** statement (e.g., **`set`** `myToon.paused` **`to`** `true`). Changing the value of an attribute causes that aspect of the element's behavior or appearance to change instantly.

- *Note: In this chapter, some of the attribute names are shown in mixed case for clarity (e.g., autoScreenFade) but remember that Miniscript is not a case sensitive language. Attribute names can be typed in mixed, lower, or uppercase in Miniscript scripts.*

allowQuitKey

Type: boolean
Readable: no
Writable: yes

Set this project attribute to true (the default) to allow **⌘-Q** (on Macintosh) or **Alt-F x** (on Windows) to be used to close the title. Set this attribute to false to disable these quit shortcuts.

The *Close Project* command can also be used to close mTropolis titles. See "Close Project (Message/Command Menu Only)" on page 13.246.

asset

Type: string or object reference
Readable: yes (as object reference)
Writable: yes (as string or object reference)

When read, this attribute returns an object reference to the media asset that is currently linked to the element. Changing the value of this attribute changes the media contained in the element. When setting this attribute, either an object reference to a new asset or a string, that contains the name of the new media asset as it appears in the Asset Palette, can be used.

For example, the following Miniscript statement might be used to set this attribute with a string:

```
set myelement.asset to "mymovie.moov"
```

The attribute could also be set with an object reference. For example, the following statement sets the asset of element "myelement" to be the same as the asset used in the element named "otherelement":

```
set myelement.asset to \
    otherelement.asset
```

The AssetManager component also holds object references to linked media. The following statement sets the element's asset to the second media asset in the AssetManager:

```
set myelement.asset to \
    AssetManager.asset[2]
```

Note that the new asset must be of the correct media type for the element (i.e., you cannot change the type of the element by assigning it a new asset of a different type). When using a string to set this attribute, keep in mind that an asset name is *not* a filename—the media must have been linked to the current project before it can be used with the asset attribute.

- *Note: For assets to be dynamically changed in a built title, they must actually be used in a scene (so the build title process knows to export the assets to the finished title file). Simply create a scene that is never actually shown as a placeholder for such assets.*

asset[*n*]

Type: object reference
Readable: yes
Writable: no

This subscripted AssetManager attribute represents a list of object references to the media assets linked to the project. Valid values for *n* range from 1 (the first asset in the project)

to `AssetManager.count` (the last asset in the project).

- *Note: The asset[n] attribute does not necessarily represent the n^{th} asset in the Asset Palette as text elements, color tables, and the system color table (i.e., the "Macintosh 8bit" color table) are also included in the asset count. Experimentation may be required to find which numbers correspond to which assets.*

autoScreenFade

Type: boolean
Readable: no
Writable: yes

Set this WorldManager attribute to true to enable automatic fades between the scenes of a project. This fade is a built-in, full screen fade. When a scene ends, the entire screen goes dark, the next scene is loaded, any color table switching that activates on Scene Started occurs, then the screen brightens to display the new scene.

This attribute only works with 256 color (8-bit) projects.

- *Note: When this attribute is set to true, scene transitions (created with the Scene Transition modifier) will appear to be ignored, as they happen while the screen is darkened.*

By default, this attribute is set to false, meaning that automatic screen fades are disabled.

autoSharedScene

Type: boolean
Readable: no
Writable: yes

By default, this WorldManager attribute is set to true, causing the first scene in a subsection to be considered the shared scene. When set to false, the first scene in a subsection is *not* automatically set to be the shared scene.

The shared scene modifier (page 12.205) can be used to specify a scene to be used as the shared scene. Using the shared scene modifier implicitly sets this attribute to false.

balance

Type: integer
Readable: yes
Writable: yes

The sound panning (i.e., left/right balance of the sound in the stereo field) for a sound or QuickTime element. Valid values range from -100 to 100. Balance value -100 is full left, 0 is centered, 100 is full right.

cache

Type: boolean
Readable: yes
Writable: yes

When true, the contents of the element are cached in memory. Note that this "graphical element" attribute is not supported by mToon, sound, or QuickTime elements. Only still graphic elements (e.g., both unlinked graphic elements and elements linked to PICT files)

and text elements can be cached. See "Cache Bitmap Checkbox" on page 6.64.

cel

Type: integer
Readable: yes
Writable: yes

The animation cel currently displayed in the mToon element.

celCount

Type: integer
Readable: yes
Writable: no

The total number of cels in an mToon animation.

centerPosition

Type: point
Readable: yes
Writable: yes

An attribute of point type that contains the position of the *center* of the element with respect to the origin of its parent (i.e., the upper left hand corner of its parent). The x field contains the number of pixels that the center is to the right of the parent's origin. The y field contains the number of pixels that the center is down from the parent's origin.

Changing the value of this attribute causes the element to move so that its center is at the newly-specified center position.

clearReturnList

Type: boolean
Readable: no
Writable: yes

Set this WorldManager attribute to true to clear the scene change return list (used by the change scene, navigation, return, and open project modifiers). As a result, the Return modifier will have no effect until another scene is added to the return list. See "Add to Return List" on page 12.176 for more information about the scene change return list.

clickCount

Type: integer
Readable: yes
Writable: no

This WorldManager attribute contains the number of mouse clicks that have occurred within the system-defined double-click interval (controlled by the "Mouse" control panel on both Macintosh and Windows systems). Thus, this attribute can be used to detect multiple clicks. For example, consider the following script, which (when placed in a Miniscript modifier configured to execute on Mouse Up) sends a message called "double click" to the element when the mouse is double-clicked:

```
if WorldManager.clickcount = 2 then
  send "double click"
end if
```

clickedLine

Type: integer
Readable: yes
Writable: no

The line number where the cursor was last positioned in a text element. The first line of a text element is line number 1.

- *Note: Lines are defined by where hard returns are placed in the text, not by text wrapping.*

clone

Type: boolean
Readable: no
Writable: yes

Set this attribute to true to create a new instance of the element. Setting this attribute has the same effect as sending the element the *Clone* command. Note that cloning does not occur immediately; mTropolis sends a Cloned message to the new element when it is created. See "Cloned/Clone" on page 13.236.

See also, "kill" on page 15.285

combineRedraws

Type: boolean
Readable: yes
Writable: yes

This WorldManager attribute controls the way in which mTropolis updates the screen. By default, this attribute is set to true. When this attribute is set to true, mTropolis collects all changes to the screen in an offscreen buffer and then updates the changed region of the screen in its entirety. Thus, multiple mToons or other moving elements in a scene will appear to change at the same time. However, if the changing region of the screen grows larger (as would happen if two mToons moved far apart), animations may appear to get slower.

When this attribute is set to false, mTropolis updates changing areas of the screen individually as they change. Thus, multiple animations may appear to update asynchronously, but the overall time to update the screen will appear more constant.

In general, the default behavior (combineRedraws set to true) provides higher performance and a more pleasing effect on most platforms.

controllerClick

Type: boolean
Readable: yes
Writable: yes

If this attribute is set to true, user mouse clicks on the QuickTime movie controller are sent only to QuickTime; they are not passed to the mTropolis QuickTime element.

The QuickTime controller is not visible by default. See "showController" on page 15.291.

count

Type: integer
Readable: yes
Writable: no

This AssetManager attribute contains the number of assets in the project. Note that the total count of assets includes text elements, color tables, and the system (i.e., "Macintosh 8bit") color table.

currentHotspot

Type: integer
Readable: yes
Writable: no

An integer that contains the ID number of the QuickTime VR panorama movie hotspot currently under the mouse. These values range from 0 to 255.

currentNodeName

Type: string
Readable: yes
Writable: no

A string that contains the name (if any) of the currently-displayed node in a QuickTime VR panorama movie.

See also, "node" on page 15.288.

currentScene

Type: object reference
Readable: yes
Writable: yes

This WorldManager attribute contains an object reference to the currently-visible scene. Reading this attribute is the same as referencing the `activeScene` Miniscript keyword. Changing the value of this attribute causes the scene to change. Note that scenes can also be changed using the change scene modifier (page 12.136) or navigation modifier (page 12.174).

cursorElement

Type: object reference or string
Readable: no
Writable: yes

This WorldManager attribute can be used to change the cursor from its normal appearance into a graphic element (including an mToon or QuickTime element). Set the cursorElement attribute to an object reference to change the cursor into the specified element. Alternatively, this attribute can be set to a string that contains the name of the element to be used as the cursor.If the specified element is visible, it will appear to jump from its current location to the location of the mouse cursor.

In this mode, the cursor does not respond to the Change Cursor modifier, nor does it automatically change to the "hand" pointer when it is over mouse message-sensitive objects. Mouse movements control the

position of the element, but it otherwise retains all of its attributes (including its position in the layer order) and programming.

Cursor elements generate mouse events in the same way as normal cursors, with one exception. The Mouse Over message is generated only when the cursor element is actually above an element in the layer order (i.e., when the cursor element's layer order number is greater than the layer order number of the element it passes over).

For example, to use an mToon element named "myToon" as the cursor, execute the script:

```
set WorldManager.cursorElement \
  to myToon
```

To return the cursor to its normal operation, set this attribute to the special keyword **none**. For example:

```
set WorldManager.cursorElement to none
```

cursorHotspot

Type: point
Readable: no
Writable: yes

This WorldManager attribute, designed for use with the cursorElement attribute (page 15.281), controls the location of a cursor element's "hotspot" (i.e., the point at which user mouse actions are registered). By default, the hotspot is located at the origin of the element (its upper left corner). The value of cursorHotspot specifies an offset to the right and down from the element's origin. This point becomes the point at which user mouse actions are registered.

This attribute only works when an element is being used as the cursor (via the cursorElement attribute). It has no effect on standard cursors.

direct

Type: boolean
Readable: yes
Writable: yes

When true, the element is drawn "direct to screen". See "Direct to Screen Checkbox" on page 6.64. When false, the element is drawn in its regular position in the layer order.

duration

Type: integer
Readable: yes
Writable: no

The length of a movie in QuickTime timevalues. To find the length of a movie in seconds, divide this value by the movie's timescale attribute.

editable

Type: boolean
Readable: yes
Writable: yes

When true, the text element can be edited in runtime mode by the user. In runtime mode, the cursor changes to an I-beam when passed over the element to indicate that it is editable. When the user clicks on the element, an

insertion point appears in the text just as if the *Enable Editing* command (page 13.234) had been sent to the element.

When this attribute is false (the default), the text cannot be edited.

ejectCD

Type: boolean
Readable: no
Writable: yes

Set this System attribute to true to eject the CD from the CD-ROM drive. Use this attribute when you need to prompt the user to insert a new CD in a multiple-disc title. See "Title Segments" on page 2.38 and "Deploying Multiple-Disc Titles" on page 2.45 for more information on creating multiple-disc titles.

flushPriority

Type: integer
Readable: no
Writable: yes

This attribute can be used to control the priority with which mTropolis handles preloaded media. To use this feature, set an element's flushPriority attribute to the desired priority value before sending the element a *Preload Media* command. These priorities are integer values starting at 0—higher values have a higher priority as described below:

- 0-50: These are the "system" priorities assigned automatically by mTropolis when media is loaded. These priorities should not be used with flushPriority.
- 51-74: These are "manual" priorities for use with flushPriority. A higher value means that the media is less likely to be removed from memory. Media loaded with these priorities are automatically flushed when a scene change occurs.
- 75-99: More "manual" priorities for use with flushPriority. Media loaded with these priorities are *not* automatically flushed when a scene changes. They are persistent until manually removed with a *Flush Media* or *Flush All Media* command.
- 100 and higher: Media preloaded with priorities of 100 and higher are never removed from memory by mTropolis, even if a dangerous (i.e., system crashing) low memory situation occurs. Such priorities should be used with great caution.

Once assigned a flushPriority, media can be selectively flushed by sending the *Flush All Media* command to the project with an accompanying data value. All elements with flushPriorities less than or equal to this value are removed from memory. See "Flush All Media (Message/Command Menu Only)" on page 13.246.

fov

Type: floating-point
Readable: yes
Writable: yes

The current field of view for the QuickTime VR panorama movie, in degrees. Valid values range from 0 (fully zoomed in) to 90 (fully zoomed out).

gameMode

Type: boolean
Readable: no
Writable: yes

Set this System attribute to true to give a Macintosh title maximum system resources. When gameMode is set to true, the Finder is essentially shut down. This setting is not compatible with titles being run over a network. File access and other system maintenance features are shut off while gameMode is active. As a result, this feature should be used with caution.

Set gameMode to false to return the system to normal operation.

This attribute is Macintosh-only. It has no effect when set in titles built for Windows platforms.

globalOffset

Type: point
Readable: yes
Writable: yes

This WorldManager attribute represents an offset of the entire project within the drawing region of the project (see "Draw Area Size Pop-Up Menu" on page 3.50). Changing `WorldManager.globalOffset` from its default of (0,0) causes all visible elements to appear shifted by the specified amount inside the drawing region. This change is persistent across scene changes. This feature can be used to allow users to view and interact with scenes that are larger than the draw area of the project.

- *Note: The draw area should not be shifted such that the boundaries of the scene enter the draw area. Attempting to draw in the empty, exposed draw area that results from such a shift may cause unpredictable results.*

globalPosition

Type: point
Readable: yes
Writable: yes

A point that contains the position of the element with respect to the origin of the draw area (e.g., the upper left corner of the draw area). The x field contains the number of pixels to the right of the draw area origin. The y field contains the number of pixels down from the draw area origin.

See also, "position" on page 15.289.

height

Type: integer
Readable: yes
Writable: yes

The height of the element (i.e., its "y" size) in pixels.

Elements resize around their origin (i.e., their top left corner), so the bottom boundary of the element moves when this value is changed.

hotspotName[*n*]

Type: string
Readable: yes
Writable: no

This attribute contains the name of each hotspot in a QuickTime VR panorama movie associated with each hotspot ID number, *n*. For example, `hotspotName[10]` is a string that contains the name associated with hotspot ID 10.

kill

Type: boolean
Readable: no
Writable: yes

Set this attribute to true to remove the element from the project. Setting this attribute has the same effect as sending the element the *Kill* command. Note that the element is not killed immediately; mTropolis sends a Killed message to the element just before it is destroyed. The same caveats apply to this attribute as apply to the *Kill* command. See "Killed/Kill" on page 13.237.

See also, "clone" on page 15.280.

layer

Type: integer
Readable: yes
Writable: yes

The layer order number of the element. See "Layer Order" on page 10.96. If an element's layer order number is set to a layer that is already occupied by another element, the elements exchange layer numbers.

line[*n*]

Type: string
Readable: yes
Writable: yes

The text contained in line number *n* of the text element (where *n* is an integer from 1 to linecount). For example, to set the value of the second line of text element "myText", use the statement:

```
set myText.line[2] to "mFactory"
```

- *Note: Lines are defined by where hard returns are placed in the text, not by text wrapping.*

lineCount

Type: integer
Readable: yes
Writable: no

The total number of lines of text in the text element.

- *Note: Lines are defined by where hard returns are placed in the text, not by text wrapping.*

lineHeight

Type: integer
Readable: yes
Writable: no

The height, in pixels, of the first line in the text element.

load

Type: boolean
Readable: no
Writable: yes

Set this scene attribute to true to cause the scene to be loaded into memory if it is not already. See also "unload" on page 15.293 and "locked" on page 15.286.

locked

Type: boolean
Readable: yes
Writable: yes

This scene attribute controls whether or not a scene can be unloaded from memory once it has been loaded. The default is false, meaning that the scene can be unloaded. Set this attribute to true to lock the scene in memory. Once locked, the scene cannot be unloaded until this attribute is set back to false.

loop

Type: boolean
Readable: yes
Writable: yes

When true, the time-based media (e.g., mToon, QuickTime movie, sound) in the element starts playing again from its beginning when it reaches its end. When false, the media plays only once.

loopBackForth

Type: boolean
Readable: yes
Writable: yes

When true, the time-based media in the element plays backward when it reaches its end, then plays forward again when it reaches its beginning.

For QuickTime movies, the "loop" attribute should also be set to true or looping will not continue.

macSndBufferSize

Type: integer
Readable: yes
Writable: yes

This Macintosh-only WorldManager attribute controls the size of the buffer used to play a sound. When set to 0 (the default), mTropolis sets the size of this buffer automatically, starting with a size of 32K. Each sound is allocated this much buffer space. Changing this value sets the size of the sound buffer manually. The integer value represents the size of the buffer in bytes. Manually setting the size of the sound buffer to a value larger than 32K (i.e., greater than 32*1024 bytes) may improve sound performance in situations where "stuttering" or dropouts occur.

Setting this attribute affects the next sound that is played. It does not affect sounds that are already playing.

See also "winSndBufferSize" on page 15.295.

masterVolume

Type: integer
Readable: yes
Writable: yes

This System attribute acts as a volume control for the entire project. Valid values range from 0 (silence) to 7 (full volume).

- *Note: This attribute works by setting the overall system volume control, affecting other applications in addition to the mTropolis title.*

mediaSize

Type: point
Readable: yes
Writable: no

The original size of the graphical media linked to the element (i.e., the size to which the element would change if **Revert Size** were selected from the Object menu). The x field contains the original width of the element, in pixels. The y field contains the original height of the element, in pixels.

- *Note: Text elements do not support this attribute.*

monitorBitDepth

Type: integer
Readable: yes
Writable: yes

This System attribute can be used to retrieve or set the current color depth setting (in bits) of the Macintosh screen (this attribute has no effect in titles built for Windows platforms).

Valid values for this attribute are:

- 1 for "B/W" mode (i.e., 1-bit black and white).
- 2 for "4" color mode (i.e., 2-bit color).
- 4 for "16" color mode (i.e., 4-bit color).
- 8 for "256" color mode (i.e., 8-bit palette color).
- 16 for "Thousands" of colors (i.e., high color).
- 32 for "Millions" of colors (i.e., true color).

Note that the color depth of the project itself is set as a project preference. See "Color Depth Pop-Up Menu" on page 3.51. Color depths supported by the current Macintosh monitor can be found by using the supportsBitDepth attribute described on page 15.291.

movieClick

Type: boolean
Readable: yes
Writable: yes

For QuickTime videos, this attribute defaults to false. If this attribute is set to true, user mouse clicks on the QuickTime movie are not sent to mTropolis, but are handled by QuickTime itself. The movie will pause when clicked and play when double-clicked.

For QuickTime VR movies, this attribute defaults to true. If this attribute is set to false, user mouse actions over the QuickTime VR movie do not let the user navigate the movie (the default); instead, mouse actions are

passed to mTropolis. This feature is useful for temporarily suspending QuickTime VR navigation so that a movie could be made draggable.

name

Type: string
Readable: yes
Writable: yes

The name of the element, as set in its Element Info dialog box. See "Element Name Field" on page 6.62.

node

Type: integer
Readable: yes
Writable: yes

The ID number of the currently-displayed node in a QuickTime VR panorama movie. Changing this value changes the view displayed in the movie.

objectID

Type: integer
Readable: yes
Writable: no

A unique ID assigned to each element by mTropolis.

pan

Type: floating-point
Readable: yes
Writable: yes

For Quicktime VR panorama movie elements, this attribute represents the horizontal pan setting of the currently-displayed view. Valid values range from 0 to 360 degrees.

parent

Type: object reference
Readable: yes
Writable: yes

This attribute contains an object reference to the element's parent component. Often, this attribute is used like the next and previous keywords to specify a relative destination for a message. However, this attribute can also be set.

Setting the value of this attribute to a new component causes the element to become a child of the newly-specified component. The structure of the project changes to reflect the new parent/child relationship. mTropolis also sends a Parent Changed message to the element (see "Parent Changed" on page 13.243).

- *Note: If the runtime Player Emulation option is turned off (i.e., if the **File-Run-Player Emulation** menu toggle is unchecked), this change will be persistent between runtime and edit mode. Once an element is re-parented, examining the structure view upon returning to edit mode will show the changed project*

structure. Reparenting of components is not persistent if ***File-Run-Player Emulation*** *is checked (the default).*

For example, suppose a graphic element named "red" is the child of another graphic element (named "blue") in a scene. The "red" element could be made a child of the scene (and thus become a sibling of "blue" instead of blue's child) by executing the following Miniscript, located on the "red" element:

```
set element.parent to scene
```

paused

Type: boolean
Readable: yes
Writable: yes

When true, the time-based media (e.g., mToon, QuickTime, or sound) in the element is in its paused state. When false, the element is not paused. Changing the value of this attribute is equivalent to sending the element the *Toggle Pause* command. There are a number of pause-related messages and commands—see "Paused/Pause" on page 13.240, "Unpaused/Unpause" on page 13.240, and "Toggle Pause (Message/Command Menu Only)" on page 13.240.

playEveryFrame

Type: boolean
Readable: yes
Writable: yes

When true, every frame in the QuickTime movie will be played regardless of the rate (audio may be dropped or go out-of-sync). When false, frames may be dropped to display the movie at its proper rate with audio in sync.

position

Type: point
Readable: yes
Writable: yes

An attribute of point type that contains the position of the element with respect to the origin of its parent (i.e., the upper left hand corner of its parent, position (0,0)). The x field contains the number of pixels to the right of the parent's origin. The y field contains the number of pixels down from the parent's origin.

Changing the value of this attribute causes the element to move to the newly-specified position.

postponeRedraws

Type: boolean
Readable: no
Writable: yes

Set this WorldManager attribute to true to suspend updates to the entire screen. While this attribute is set to true, no changes to elements appear on the screen, though elements are still active and may be changing their position or appearance. All changes are drawn to the offscreen buffer only.

Set this attribute to false (the default) to restore the normal operation of the screen and

display the current contents of the offscreen buffer.

This attribute is useful when many changes need to be made to the screen, but the author wants them to be revealed simultaneously.

To suspend screen updates for individual elements, use the redraw attribute (page 15.290).

range

Type: integer range
Readable: yes
Writable: yes

The range of cels to be played in an mToon animation. The range of timevalues to be played in a QuickTime movie.

rate

Type: integer (for mToons)
floating-point (for QuickTime)
Readable: yes
Writable: yes

For mToons, this value is the playback speed in frames per second. For QuickTime, this value is a rate multiplier where the movie's default speed is represented by 1. Higher values make the movie play faster; lower values make the movie play slower. Negative values make the movie play in reverse. For example, setting this value to -2 would make the movie play backward at twice its normal speed.

redraw

Type: boolean
Readable: no
Writable: yes

Set this attribute to false to make the element stop showing screen updates as it changes. For example, if this attribute is set to false on an mToon element, the animation will appear to have stopped. Similarly, hiding an element after this attribute has been set to false will make the element insensitive to user mouse actions, but the image of the element will remain on the screen until other elements move across that region. As they move, they will remove the old image as that part of the screen is redrawn.

Set this attribute to true (the default) to make the element show screen updates once again.

To suspend screen updates for the entire screen, use the postponeRedraws attribute (page 15.289).

refreshCursor

Type: boolean
Readable: no
Writable: yes

This WorldManager attribute can be used to "refresh" the appearance and messaging status of the mouse cursor. Set this attribute to true to cause the position of the cursor with respect to elements in the scene to be evaluated. This causes mouse messages, such as Mouse Over or Mouse Outside to be sent to elements that should receive those messages. This feature is

useful because, for performance reasons, messages such as Mouse Over are only generated when the user moves the mouse over an element. Such messages are not generated when a moving element moves under a stationary cursor.

regPoint

Type: point
Readable: yes
Writable: no

The offset (a point value) from the mToon element's origin, to the mToon's registration point. See "Align and Trim Cels" on page 2.27.

scrollOffset

Type: point
Readable: yes
Writable: yes

A point value that describes the current offset of the media within the frame of the element. Changing the value of this attribute is similar to sending *Scroll Up, Scroll Down, Scroll Right,* or *Scroll Left* commands to an element These commands are described on page 13.235.

showController

Type: boolean
Readable: yes
Writable: yes

When true, the QuickTime movie's standard play controls are visible. When false, the controller is hidden. This attribute can only be used with QuickTime movies that are set to play "direct to screen". See "direct" on page 15.282 and "Direct to Screen Checkbox" on page 6.64.

showCursor

Type: boolean
Readable: yes
Writable: yes

When true (the default), the cursor changes to indicate QuickTime VR panorama hotspots when it passes over them. When false, the cursor does not change.

size

Type: point
Readable: yes
Writable: yes

A point value that contains the width and height of the element. The x field contains the width of the element, in pixels. The y field contains the height of the element, in pixels.

supportsBitDepth[*n*]

Type: boolean
Readable: yes
Writable: no

This read-only System attribute can be used to query which color depths a Macintosh monitor supports. This attribute has no effect when used in titles built for Windows platforms.

The value of supportsBitDepth[*n*] is true if the Macintosh monitor is capable of displaying

graphics in the bit depth specified by *n*. Valid values for *n* are:

- 1 for "B/W" (i.e., 1-bit black and white).
- 2 for "4" color mode (i.e., 2-bit color).
- 4 for "16" color mode (i.e., 4-bit color).
- 8 for "256 color" (i.e., 8-bit palette color).
- 16 for "Thousands" of colors (i.e., 16-bit high color).
- 32 for "Millions" of colors (i.e., 32-bit true color).

The monitorBitDepth attribute (page 15.287) can be used to change the current Macintosh monitor settings. For example, the following script changes the Macintosh display to 8-bit ("256" color mode) if it is capable:

```
if System.supportsBitDepth[8] then
   set System.monitorBitDepth to 8
end if
```

text

Type: string
Readable: yes
Writable: yes

The text string displayed in a text element. Changing the value of this attribute causes the text element to update.

tilt

Type: floating-point
Readable: yes
Writable: yes

The current vertical panning for the QuickTime VR panorama movie, in degrees. Valid values range from -90 (looking straight down) to 90 (looking straight up).

timescale

Type: integer
Readable: yes
Writable: no

The rate of the QuickTime movie in QuickTime timevalues per second. To compute the movie's length in seconds, divide the movie's duration attribute by this value.

timevalue

Type: integer
Readable: yes
Writable: yes

The current time in the QuickTime movie (in QuickTime-specific units). To compute the current time in seconds, divide this value by the movie's timescale attribute.

trackCount

Type: integer
Readable: yes
Writable: no

The number of tracks in a QuickTime movie.

trackDisable

Type: integer or string
Readable: no
Writable: yes

Set this attribute to an integer (representing a QuickTime track number) or a string (representing a QuickTime track name) to disable the specified QuickTime track.

trackEnable

Type: integer or string
Readable: no
Writable: yes

Set this attribute to an integer (representing a QuickTime track number) or a string (representing a QuickTime track name) to enable the specified QuickTime track.

unload

Type: boolean
Readable: no
Writable: yes

Set this scene attribute to true to unload a previously-loaded scene from memory. Note that the current scene cannot be unloaded using this attribute (as such an operation would present the user with a blank, inoperative screen). Also, scenes that have their locked attribute set to true cannot be unloaded. See also "load" on page 15.286 and "locked" on page 15.286.

updateMode

Type: string
Readable: yes
Writable: yes

A string that represents the way in which the user's view of a QuickTime VR movie changes when its location is changed (by changing the node, pan, tilt, and fov attributes). Valid values are:

- "normal": The movie updates to the new location as soon as the location is set. The view appears to "jump" instantly to the new location.
- "none": The movie does not update.
- "swing": The view updates with a "swing" transition (i.e., it pans smoothly) to the new location. This setting is the default.

userTimeout

Type: integer
Readable: yes
Writable: yes

This project attribute represents a length of time after which the User Timeout message is sent. This value is measured in 1/60 second intervals. For example, to generate User Timeout messages at intervals of 1 second, set this attribute to 60. See "User Timeout" on page 13.246.

visible

Type: boolean
Readable: yes
Writable: yes

When true, the element is visible. When false, the element is hidden. Setting this attribute to true is equivalent to sending the *Show* command (see "Shown/Show" on page 13.234). Setting this attribute to false is equivalent to sending the *Hide* command (see "Hidden/Hide" on page 13.234).

volume

Type: integer
Readable: yes
Writable: yes

An integer value representing a percentage of the sound's full volume. A value of 0 indicates that the sound will be completely silent when played. A value of 100 indicates that the sound will play at full volume.

volumeIsMounted

Type: boolean
Readable: yes
Writable: no

Use this System attribute, in conjunction with the volumeName System attribute, to check whether a CD with a specified volume name is currently in the CD-ROM drive. Set `System.volumeName` to a string that contains the name of the volume that you want to check for, then examine the contents of `System.volumeIsMounted`. This attribute will contain true if the specified volume is in the CD-ROM drive, otherwise it will contain false. See "volumeName" on page 15.294 for an example of using these attributes.

volumeName

Type: string
Readable: no
Writable: yes

Use this System attribute, in conjunction with the volumeIsMounted WorldManager attribute, to check whether a CD with a specified volume name is currently in the CD-ROM drive. Set `system.volumeName` to a string that contains the name of the volume that you want to check for, then examine the contents of `system.volumeIsMounted`. This attribute will contain true if the specified volume is in the CD-ROM drive, otherwise it will contain false. For example:

```
set System.volumeName to "myCD"
if System.volumeIsMounted then
  send "correct CD in drive"
else
  send "requested CD not in drive"
end if
```

warpMode

Type: string
Readable: yes
Writable: yes

A string that represents the way warping is being used to display the QuickTime VR panorama movie. Valid values are:

- "two": Two-dimensional warping is being used.
- "one": One-dimensional warping is being used.
- "none": No warping.

width

Type: integer
Readable: yes
Writable: yes

The width of the element (i.e., its "x" size) in pixels.

Elements resize around their origin (i.e., their top left corner), so the right boundary of the element moves when this value is changed.

winSndBufferSize

Type: integer
Readable: yes
Writable: yes

This Windows-only WorldManager attribute controls the size of the buffer used to play sounds. This size is the total amount of sound buffer space available to *all* sounds. When set to 0 (the default), mTropolis sets the size of this buffer automatically, depending upon the type of sound that is playing:

- for 16-bit/44KHz sounds: 160K
- for 16-bit/22KHz sounds: 88K
- for lower quality formats, including 8-bit/22KHz sounds: 40K

Changing this value sets the size of the sound buffer manually. The integer value represents the size of the buffer in bytes. Manually setting the size of the sound buffer to a larger value may improve sound performance in situations where "stuttering" or dropouts occur.

See also "macSndBufferSize" on page 15.286.

LISTS OF ATTRIBUTES BY COMPONENT TYPE

The tables below (Table 15.1 through Table 15.11) show the attributes that can be accessed for each type of mTropolis component. Also shown is the attribute's corresponding data type and two columns labeled "R" and "W".

- If a bullet appears in an attribute's "R" column, the attribute is *readable*. For these attributes, using the syntax *element.attribute* in a script returns the current value of *attribute* (which has the data type shown in the "Type" column) for the specified *element*.
- If a bullet appears in an attribute's "W" column, the attribute is *writable*. The value of the attribute can be changed by using the **`set`** statement (e.g., **`set myToon.paused to true`**). Changing the value of an attribute causes that aspect of the element's behavior or appearance to change instantly.

Note that not all element types support every attribute. Consult Table 15.1 through Table 15.11 for lists of attributes supported by each element type. In addition to the

attributes shown below, keep in mind that the `project`, `section`, `subsection`, `scene`, `element`, and `parent` "building blocks" described in Table 14.2 are essentially attributes of each element though they are not all shown in the tables below.

Shared Attributes of 'Graphical' Elements

The following attributes (Table 15.1) are common to graphic elements, mToon elements, sound elements, text elements, and QuickTime elements.

Graphical Attribute	Type	R	W
asset	obj/string	•	•
cache†	bool	•	•
centerPosition	point	•	•
clone	bool		•
direct‡	bool	•	•
flushPriority	int		•
globalPosition	point	•	•
height	int	•	•
kill	bool		•
layer	int	•	•
mediaSize	point	•	
name	string	•	•
objectID	int	•	
parent	obj	•	•
position	point	•	•
redraw	bool		•
scrollOffset	point	•	•
size	point	•	•
visible	bool	•	•
width	int	•	•

Table 15.1: Shared attributes of graphic, mToon, sound, text, QuickTime elements, and mTropolis modifiers. †cache is only an attribute of PICT and text elements. ‡direct is not supported by QuickTime VR elements.

mToon Attributes

The following attributes (Table 15.2) are unique attributes for mToon elements.

mToon Attribute	Type	R	W
cel	int	•	•
celCount	int	•	
loop	bool	•	•
paused	bool	•	•
range	range	•	•
rate	int	•	•
regPoint	point	•	

Table 15.2: Attributes of mToon elements

Project Attributes

The following attributes (Table 15.3) are unique to the project component.

Project Attributes	Type	R	W
allowQuitKey	bool		•
userTimeout	int	•	•

Table 15.3: Attributes of the project component

QuickTime Attributes

The following attributes (Table 15.4) are unique to QuickTime elements.

QuickTime Attribute	Type	R	W
balance	int	•	•
controllerClick	bool	•	•
duration	int	•	
loop	bool	•	•
loopBackForth	bool	•	•
movieClick	bool	•	•
paused	bool	•	•
playEveryFrame	bool	•	•
range	range	•	•
rate	float	•	•
showController	bool	•	•
timeScale	int		•
timeValue	int	•	•
trackCount	int	•	
trackDisable	int/string		•
trackEnable	int/string		•
volume	int	•	•

Table 15.4: Attributes of QuickTime elements

QuickTime VR Attributes

The following attributes (Table 15.5) are unique to QuickTime VR panorama movie

elements (which also support the QuickTime attributes listed above).

QuickTime VR Attribute	Type	R	W
currentHotspot	int	•	
currentNodeName	string	•	
fov	float	•	•
hotspotName[*n*]	string	•	
movieClick	bool	•	•
node	int	•	•
pan	float	•	•
showCursor	bool	•	•
tilt	float	•	•
updateMode	string	•	•
warpMode	string	•	•

Table 15.5: Attributes of QuickTime VR panorama elements

Scene Attributes

The following attributes (Table 15.6) are unique to scene components.

Scene Attribute	Type	R	W
load	bool		•
locked	bool	•	•
unload	bool		•

Table 15.6: Attributes of scene components

Sound Attributes

The following attributes (Table 15.7) are unique to sound elements. Note that, for sound elements, "positioning" attributes such as position, size, and globalPosition are inherited from the element's parent (because sound elements have no "physical" representation in the layout view).

Sound Attribute	Type	R	W
balance	int	•	•
loop	bool	•	•
paused	bool	•	•
volume	int	•	•

Table 15.7: Attributes of sound elements

Text Attributes

The following attributes (Table 15.8) are unique to text elements.

Text Attribute	Type	R	W
clickedLine	int	•	
editable	bool	•	•
line[*n*]	string	•	•
lineCount	int	•	
lineHeight	int	•	
text	string	•	•

Table 15.8: Attributes of text elements

AssetManager Attributes

The AssetManager is the mTropolis component that controls media assets. This component supports a number of attributes relating to media assets that have been linked to the project.

In Miniscript statements, the `AssetManager` component can be abbreviated as `am`, if desired. For example, the

following two Miniscript **set** statements are equivalent:

```
set myint to AssetManager.count
set myint to am.count
```

The following attributes (Table 15.9) are unique to the AssetManager component.

AssetManager Attribute	Type	R	W
asset[*n*]	obj	•	
count	int	•	

Table 15.9: Attributes of the AssetManager component

System Attributes

The System is the mTropolis component that controls the execution of all open mTropolis projects. Most System attributes control hardware-related options.

The following attributes (Table 15.10) are unique to the System component.

System Attribute	Type	R	W
ejectCD	bool		•
gameMode	bool		•
masterVolume	int	•	•
monitorBitDepth	int	•	•
supportsBitDepth[*n*]	bool	•	
volumeIsMounted	bool	•	
volumeName	string		•

Table 15.10: Attributes of the System component

WorldManager Attributes

The WorldManager is the mTropolis component that controls the execution of the project. WorldManager attributes control global options.

In Miniscript statements, the `WorldManager` component can be abbreviated as `wm`, if desired. For example, the following two Miniscript **set** statements are equivalent:

```
set WorldManager.allowQuitKey to true
set wm.allowQuitKey to true
```

The following attributes (Table 15.11) are unique to the WorldManager component.

WorldManager Attribute	Type	R	W
autoScreenFade	bool		•
autoSharedScene	bool		•
clearReturnList	bool		•
clickCount	int	•	
combineRedraws	bool	•	•
currentScene	obj	•	•
cursorElement	obj		•
cursorHotspot	point		•
globalOffset	point	•	•
macSndBufferSize	int	•	•
postponeRedraws	bool		•
refreshCursor	bool		•
winSndBufferSize	int	•	•

Table 15.11: Attributes of the WorldManager component

Chapter 16. Glossary

Alias

An alias is a special copy of a modifier that takes its functionality from the modifier from which it was made. This "master copy" is automatically placed in the Alias Palette when the alias is made. Additional aliases that refer to this master copy can also be created and placed throughout a project.

The advantage of using aliases is that they can be globally updated from a single source. Changing the settings of an alias changes the settings of both the master copy and all other aliases that refer to the same original throughout the project.

Asset

A media file that has been linked to a project is called an asset. mTropolis compatible files include: PICT still images, AIFF sounds, mToon animations (mTropolis' animation format), QuickTime video, and QuickTime VR panoramas.

Author Message

A message that has been created by the author of a mTropolis project is called an author message. Author messages can be sent from messengers in the same way that mTropolis' built-in messages and commands can be sent.

Behavior

The "behavior" modifier is a special modifier that can be used to encapsulate other mTropolis modifiers. Behaviors can be made "switchable" so that they activate and deactivate upon the receipt of messages. Behaviors allow complex interactions to be created and organized.

Cel

A single frame of an mToon animation.

Child

All components directly contained by another component are considered its children. For example, a graphic modifier and an element transition modifier contained by the same element are children of that element.

Commands

Commands are a special type of message that act directly upon an element or the element's linked media. Unlike other mTropolis messages and author messages, commands act only upon the element to which they are sent.

Component

Any discrete part of a mTropolis project is called a component. Components include structural organizers (e.g., the project, section, and subsection components), media

containers (e.g., scenes, graphic, and text elements), and modifiers (e.g., messengers, graphic modifiers, etc.).

Descendant

All components contained by another component are called descendants of that container. For example, all items in a project are the descendants of the project component.

Element

Elements are mTropolis components that contain media assets. Scene components are a special type of element that both contain media and act as structural components. Double-click an element to display its "Element Info" dialog box that can be used to configure its default display properties.

Environment Message

Environment messages or the messages that mTropolis sends to the components of a project when it detects changes in the runtime environment. For example, elements are informed of user mouse clicks by the Mouse Up and Mouse Down environment messages.

Hierarchy

A basic organizational principle in mTropolis' authoring environment is the hierarchy. mTropolis projects have a hierarchical structure composed of sections, subsections, scenes and elements. A section acts as a parent of its subsections, a subsection acts as the parent of its scenes, and a scene acts the parent of its elements. Elements can also be parents of other elements. This structure helps organize a project, and provides a pathway for message passing through the project.

Ink

The graphic modifier's "ink" setting controls how an element's media is displayed on the screen. For example, some ink effects mix the foreground and background colors with the element's color, effectively tinting the image.

Layer Order

Layer order is the order in which elements are drawn on the screen. When new elements are added to a scene, they draw on top of previous elements. mTropolis keeps an internal list of elements in a scene and the order in which they are drawn. This layer order can be changed using tools in the authoring environment. Drawing elements on top of each other creates the illusion that the two-dimensional (X,Y) screen has a depth dimension (Z). This effect is sometimes called "2.5D."

Library

A library is a separate file where mTropolis components can be stored. Libraries can be used to distribute portions of a project to development team members for editing, or to archive project components for reuse in other projects. Within the mTropolis environment, an open library is represented as a palette. With the exception of entire projects, any component can be dragged and dropped to or from a library palette.

Linking

Linking is the procedure used to establish a path from a mTropolis project to external media files. Media that has been linked to a project appears in the Asset Palette. Once linked, media can be dragged and dropped into the project in any view.

Messages

Messages are the means by which the components of a mTropolis project communicate. Messages are signals that are used to activate or deactivate modifiers in a project. Both the mTropolis engine and messenger modifiers pass messages between components.

mFusion Technology

The object-oriented technology underlying mFactory's mTropolis. Features of object technology such as messaging and reusability of components are built into mTropolis tools.

Miniscript

Miniscript is a simple scripting language embedded in a modifier. Its syntax is loosely based upon AppleScript, Apple's scripting language. Miniscript statements are executed when the Miniscript modifier that contains them in activated by a message. Miniscript can be used to perform mathematical operations, send messages based on conditional expressions, and send multiple messages or commands from a single modifier.

Modifier

Modifiers are mTropolis components that imbue other mTropolis components with new capabilities or properties. Modifiers are used by dragging and dropping them onto elements. The properties of a modifier become a part of the component on which they are placed. For example, adding the Drag Motion modifier to an element causes that element to become draggable by users in runtime mode. Double-click modifiers to display their configuration dialogs that control modifier options.

MOM

The mFactory Object Model (MOM) is an application programming interface for multimedia programmers who want to extend the power of mTropolis by writing their own modifiers and mTropolis features in languages such as C or C++.

mToon

An mToon is an animation file in mFactory's proprietary animation format. A series of individual cels (i.e., images from PICT, PICS, QuickTime, or existing mToon files) can be compiled into a single mToon file by mTropolis' mToon editor.

mToons can be made to play in their entirety, display a single cel, or play specified ranges of cels. This precise control over mToons makes them especially useful for animated sequences. For example, a rabbit's sitting, walking and running motions can be compiled into a single mToon linked to an

element. The mToon then has a "library" of actions that can be individually accessed and played back.

Palette

A floating menu containing project tools or resources is called a palette. For example, the Asset Palette contains the media assets that have been linked to a project.

Parent

The component that directly contains another component is referred to as its "parent". All components in a project, with the exception of the project, have one parent. For example, a project is the parent of sections, a section is the parent of its subsections, a subsection is the parent of its scenes, and a scene is the parent of its elements. An element can also be the parent of other elements.

Project

The project is the mTropolis component that holds an entire title within it. The children of a project are sections. A project can contain modifiers that modify the actions or characteristics of the entire title. Titles created in the mTropolis authoring environment are referred to as projects during the development phase. Projects cannot contain other projects. The saved file that represents a mTropolis title in development is called a project file. The name of this file is the name assigned to the project component.

Scene

The structural component one level below a subsection. Scenes can contain elements that are visible to the user in runtime mode. The elements that are added to a scene draw on top of it and are attached to it. Deleting the scene deletes all the elements and modifiers attached to it. Scenes are like elements in that they can also be linked to media.

Scope

Where a modifier is placed in a project determines its scope — that is, the group of objects that may "see" it and that can access its value in mTropolis. All descendents of a variable modifier's parent are in its scope.

Section

Section components can be used to organize parts of a title into groups that logically belong together. For example, a title developer for a travel game might put everything to do with Africa under a single section. Sections are parents to subsections. As with a project, a section can contain modifiers. Sections cannot contain other sections.

Shared Scene

Special scenes that appear behind all other scenes in a subsection are shared scenes. Shared scenes are used to store elements and modifiers common to all the scenes in a subsection. For example, a background image placed on the shared scene forms the backdrop of all subsequent scenes. Elements and modifiers, such as navigational buttons, that are common to all scenes in a section are

placed in the shared scene. By default, the very first scene in a subsection is the shared scene.

Sibling

All components that share the same parent are referred to as siblings. For example, a graphic modifier and an element transition modifier contained by the same element are siblings.

Structure

The structure of a project is literally the way the project is organized. mTropolis projects consist of structural components, elements, and modifiers that interact through a messaging system. mTropolis provides a Structure Window for examining the hierarchical structure of a project.

Subsection

Subsections are components that can be used to more finely divide the content of a section, much like a subsection in a book. Subsections are the parents of scenes. As with the project and section components, a subsection can contain modifiers. Subsections cannot contain other subsections or sections.

Title

When a mTropolis project is complete, it can be compiled into a playback version called a title using the **Build Title** menu option.

Appendix A. MovieTrax

This appendix describes MovieTrax, a stand-alone Macintosh application bundled with mTropolis that allows simple editing and manipulation of QuickTime video files.

- *Note: The version of MovieTrax provided with this release of mTropolis is a "beta" version. Program features and documentation may not be complete. Features are subject to change in future releases.*

WHAT IS MOVIETRAX?

MovieTrax is a QuickTime editing application that allows the editing of *tracks* within a QuickTime file. Tracks are the basic components of a QuickTime movie that contain different types of media to be played. QuickTime supports many different types of tracks including video, audio, text, MIDI, sprite, and timecode tracks. Tracks are independent of one another and a movie can contain multiple tracks of the same type. For example, different video tracks in a movie may have different durations, compression encodings, bit depths, start times, etc.

MovieTrax can be used to create new multitrack movies from component media or to edit existing ones. Basic temporal and spatial editing options are also supported, including the creation of ranges in a movie.

Using QuickTime element attributes (see Chapter 15, "Attributes") or the track control modifier (see "Track Control Modifier" on page 12.219), mTropolis can manipulate multitrack QuickTime movies. For example, the track control modifier can be used to activate or deactivate individual tracks in a movie.

STARTING MOVIETRAX

To start MovieTrax, double-click the MovieTrax icon, found in the QuickTime utilities folder of the mTropolis distribution. The MovieTrax menus appear. MovieTrax menu options are described in the sections below.

FILE MENU

Options in the File menu can be used to open, import, and save QuickTime movies for editing with MovieTrax.

New Movie

Select this option to open a new, empty List window.

Open Movie

Select this option to open an existing QuickTime file. A standard file dialog appears. Select a QuickTime movie to open. If the movie has not previously been opened by MovieTrax, a new list window appears, listing the tracks the movie contains. Movies that have previously been opened by MovieTrax

open to show the configuration of windows visible when the movie was last saved.

Note that other types of component media can also be opened and converted into QuickTime movies using this option. Valid files are displayed in the file selection dialog and the "Open" button changes to "Convert" button when they are highlighted. Click "Convert" to open the media file and convert it to a QuickTime movie. The media becomes available in MovieTrax as a QuickTime track.

Import Tracks

Select this option to import the tracks from a QuickTime file directly into the currently-active movie (i.e., the movie associated with the currently-active view).

Export Tracks

Select this option to save only the currently-selected tracks as a new QuickTime file. A standard file selection dialog appears.

- *Note: Assigned ranges are not exported with tracks.*

Close

Select this option to close the currently-active window.

Close Project

Select this option to close all open windows and their associated files. Applies to currently-active movie.

Save

Select this option to save the currently-active movie with its current filename. If the movie has not yet been saved, a standard file selection dialog appears. Enter a name for the movie and select "Save". Select the "Make movie self-contained" checkbox to create a movie that is independent of its original source files.

Save As

Select this option to save the currently-active movie with a new name. A standard file selection dialog appears. Enter a name for the movie and select "Save". Select the "Make movie self-contained" checkbox to create a movie that is independent of its original source files.

Quit

Select this option to quit MovieTrax. If there are any unsaved or changed movies open, MovieTrax asks if they should be saved before quitting.

EDIT MENU

MovieTrax supports the following standard edit options.

Undo

Select this option to undo the last operation. Note that not all operations can be undone.

Cut

Select this option to cut the current selection and place it on the clipboard. Note that tracks cannot be cut.

Copy

Select this option to copy the current selection to the clipboard. Note that tracks cannot be copied.

Paste

Select this option to paste the contents of the clipboard.

Select All

Select this option to select all tracks in the currently-active window.

MOVIE MENU

Options in the Movie menu affect all tracks in the current movie.

Movie Info

Select this option to display information about the currently-active movie.

Play/Pause

Select this option to play the currently-active movie. Note that if the Spatial view is not open, the movie plays, but the video portion is not visible.

When a movie is playing, this menu option changes to Pause. Select it to stop the currently-playing movie.

Display Time Values/Display Standard Time

Use this menu toggle to change the time format shown in the Movie Controller between QuickTime "time values" and hours:minutes:seconds.hundredths format.

Loop

Select this menu toggle to cause the movie to loop from the beginning (i.e., repeatedly play through and restart from the beginning) when it plays.

Back and Forth

Select this menu toggle to cause the movie to loop back and forth (i.e., repeatedly play forward to the end then backward to the beginning) when it plays.

Play Every Frame

Select this menu toggle to play the movie without dropping frames. Note that audio does not play when this option is checked.

Play Selection Only

Select this menu toggle to play only the currently-selected range when Play is activated.

New Range

Select this command to specify a new range. The New Range dialog (Figure A.1) appears. Enter a name for the range (if desired), and a start and end time in QuickTime units. Note that if a range selection has been made in the Movie Controller, start and end times for that range are shown in the dialog. Click "OK" to create the new range. The new range becomes available in the "Range" pop-up menu on the movie controller. Click cancel to dismiss the dialog without creating a new range.

Once defined in a movie, QuickTime ranges can be used in mTropolis by setting the

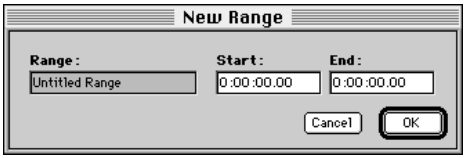


Figure A.1 The New Range dialog

movie's range attribute to a string that contains the name of the range. The next *Play* command sent to the movie will play only the specified range. Unlike mToon ranges, the ranges do not automatically appear as items in the "With" pop-up menu and cannot be sent as incoming data with the *Play* command.

For example, the following Miniscript statements could be used to play the range named "myRange" in the QuickTime movie named "myMovie":

```
set myMovie.range to "myRange"
send "Play" to myMovie
```

A messenger modifier could also be configured to set the movie's range by selecting the *Set Attribute-Set range* command in the modifier's Message/Command pop-up and typing a string containing the name of the range (e.g., the name enclosed in quotation marks) into the With pop-up menu. For example, the messenger modifier dialog shown in Figure A.2 has been configured to set the same range as in the previous Miniscript example.

TRACK MENU

These options can be used to configure the behavior and appearances of tracks within a

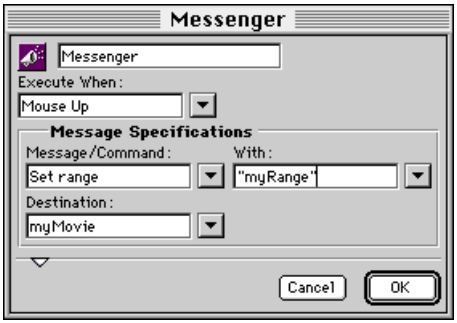


Figure A.2 A mTropolis Messenger modifier dialog configured to set a QuickTime movie's range.

movie. Note that many of these commands are only accessible when the Spatial window is open and a track has been selected in that window.

Track Info

Select this option to display information about the currently-selected track (the track can be selected in the List, Spatial, or Temporal window). The Track Info dialog appears. A number of information sections, with their own open/close triangles, are shown. Click the triangles to open or close that information section.

The "Options" section contains three checkboxes that can be set by the user. These options control various QuickTime track defaults:

- **Enabled**: Check this box (the default) to set the track as initially enabled when used in mTropolis.

- **Preload**: Check this box to set the track as initially preloaded when used in mTropolis. Note that preloading of media is limited by the memory available on the machine that plays the media. By default, this box is unchecked.
- **Cache hints**: Hints are pieces of information about how the track will play. Check this box to cache hint information when the track is initially loaded into mTropolis. The next time that track is played, performance may be improved (at the expense of using extra memory to store the hints). By default, this box is unchecked.

Half Size

Select this option to display the track currently selected in the Spatial window at half its normal size.

Normal Size

Select this option to display the track currently selected in the Spatial window at normal size (the default).

Double Size

Select this option to display the track currently selected in the Spatial window at double its normal size.

Bring to Front

Select this option to bring the track currently selected in the Spatial view to the front of any other tracks that it overlaps.

Send to Back

Select this option to send the track currently selected in the Spatial view to the back of any other tracks that it overlaps.

Bring Forward

Select this option to bring the track currently selected in the Spatial view one position forward in the "layer order" of tracks.

Send Backward

Select this option to send the track currently selected in the Spatial view one position back in the "layer order" of tracks.

Align

The options in this cascading menu can be used to align two or more tracks in the spatial view. The following options are available when two or more tracks are selected in the Spatial window:

- **Left**: Select this option to align the left edges of the selected tracks. This option is only available for tracks selected in the Spatial window.
- **Right**: Select this option to align the right edges of the selected tracks. This option is only available for tracks selected in the Spatial window.
- **Top**: Select this option to align the top edges of the selected tracks. This option is only available for tracks selected in the Spatial window.
- **Bottom**: Select this option to align the bottom edges of the selected tracks. This

option is only available for tracks selected in the Spatial window.

The following options are available when two or more tracks are selected in the Temporal window:

- **Start**: Select this option to align the start times of the selected tracks.
- **End**: Select this option to align the end times of the selected tracks.

Clip

The options in this cascading menu can be used to clip the visible area of the track currently selected in the Spatial window. Options are:

- **Crop**: Select this option to turn the selected track's resize handles (marked by red dots in the Spatial view) into cropping handles (marked by green dots). Moving the handles changes the "frame" of the track, without resizing its contents.
- **Paste**: This option is only available when a PICT image is on the clipboard. Select this option to paste the PICT image onto the current track as a clipping region. The PICT is converted to black and white—white pixels indicate a clipped region, while black pixels reveal the image underneath.
- **Invert**: Select this option to invert the clipping region of the currently-selected track.
- **Clear**: Select this option to clear the clipping region of the currently-selected track.

Matte

The options in this cascading menu can be used to specify a matte for the currently-selected track. A matte is similar to a clipping region, except that a matte has degrees of transparency and may also impart color tinting to the track. Options are:

- **Paste**: This option is only available when a PICT image is on the clipboard. Select this option to paste the PICT onto the current track as a matte. White areas of the PICT are completely opaque while black areas are completely transparent, showing the image underneath. Grayscale and colored pixels impart a tint to the image based upon their lightness.
- **Clear**: Select this option to remove a matte from the currently-selected track.

Ink

The options in this cascading menu can be used to specify an ink effect for the track currently-selected in the Spatial window. Options are:

- **Normal**: Select this option (the default) to display the selected track in its default state. This option is similar to mTropolis' "Copy" ink effect.
- **Bkgd Transparent**: Select this option to make the "Op Color" (selected with the "Set

Op Color" option, described below) transparent in the selected track.

- **Blend**: Select this option to make the "Op Color" transparent based on lightness values in the selected track. This option is similar to the mTropolis "Blend" ink effect.
- **Set Op Color**: Select this option to display a color selection dialog. Select a color to be used in the Background Transparent and Blend options described above.

Set Volume

Select this option to select the volume of the selected audio track. The Set Volume dialog appears. Use the volume slider to select a value from 0 (silent) to 100 (full volume). Click "OK" to accept the change. Click "Cancel" to dismiss the dialog without changing the audio's volume. This option is available only when an audio track is selected in the List or Temporal windows.

Set Balance

Select this option to select the stereo balance of the selected audio track. The Set Balance dialog appears. Use the volume slider to select a value from -100 (full left) to 100 (full right). Click "OK" to accept the change. Click "Cancel" to dismiss the dialog without changing the audio's stereo position. This option is available only when an audio track is selected in the List or Temporal windows.

Set Start Time

Select this option to set the start time of the selected track to the time indicated by the Movie Controller. This option is available only when a track is selected in the Temporal window.

VIEW MENU

Options in this menu can be used to show and hide the various MovieTrax display windows. Options and the windows they select are described below.

List Window

Select this menu toggle to show and hide the List window (Figure A.3). The List window shows the tracks in a movie and lists the name, type and layer number of tracks. The layer number of tracks is similar to the layer order number of elements in mTropolis. Tracks with a *lower* layer number appear "in front" of other tracks in the Spatial view.

Other features of this window include:

- Tracks can be selected by clicking on their names. Use ⌘-Click to select multiple items.

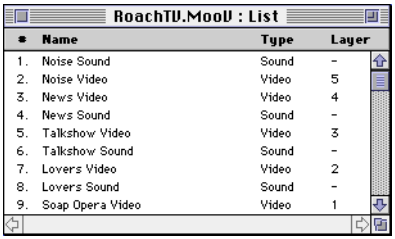


Figure A.3 The List window, shown here from a movie that contains four tracks

- Selected tracks can be deleted by pressing the Delete key.
- Tracks can be dragged and dropped into other windows.

Spatial Window

Select this menu toggle to show and hide the Spatial window (Figure A.4). The Spatial window shows the visual portion of a movie. Tracks can be repositioned in this window by dragging and dropping.

Other features of this window include:

- As a track is repositioned in the window, its x, y coordinates in pixels (with respect to the left and top edges of the window) are reported at the bottom of the window.
- Tracks can be selected by clicking them. Multiple tracks can be selected using ⌘-Click and Shift-Click.
- When a track is selected, red dots appear on its corners. These dots represent resize handles. Drag the handles to scale the track. Width and height of the track, in pixels, is reported at the bottom of the window.
- Selected tracks can be deleted by pressing the Delete key.
- When the mouse is over a track, its name is shown at the bottom of the window.
- *Note: To display a track (or multiple tracks) in the Spatial Window, you must click "Enabled" in the "Options" section of the Track Info dialog.*

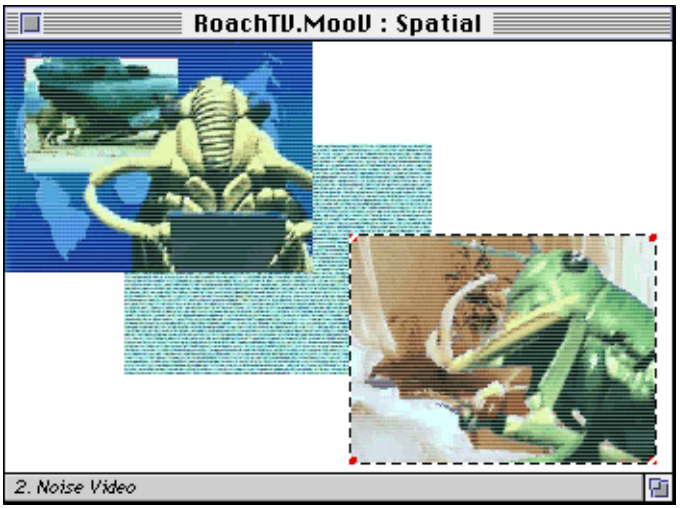


Figure A.4 The Spatial Window, shown here from a movie with three video tracks.

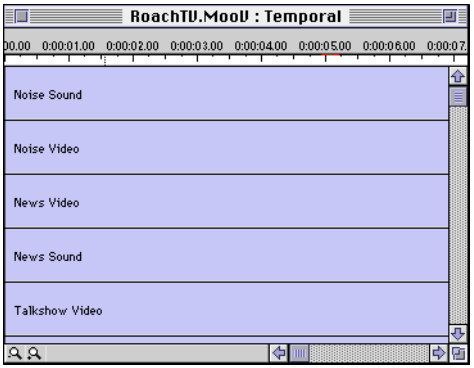


Figure A.5 The Temporal window, shown here from

Temporal Window

Select this menu toggle to show and hide the Temporal window (Figure A.5). The Temporal window shows the start and end times of tracks. The time position of a track can be changed by dragging it within the window. The start and end times of the track are shown at the bottom of the window as the track is dragged.

Other features of this window include:

- A time scale, in hours:minutes:seconds:hundredths is shown at the top of the window. The scale of the view can be changed by clicking the zoom out and zoom in tools at the bottom left corner of the window.
- Tracks can be selected by clicking on their shaded portions. Use ⌘-Click to select multiple items.
- Selected tracks can be deleted by pressing the Delete key.
- If a range of time values have been selected in the Movie Controller (by Shift-dragging the Controller's slider), the range is displayed as a yellow highlight in the time scale.

Movie Controller

Select this menu toggle to show and hide the Movie Controller (Figure A.6). The Movie Controller is similar to the standard QuickTime controller, including volume, play/pause, position slider, step, and loop controls. In addition, a time format toggle and Range pop-up menu have been added.

Features of the Movie Controller include:

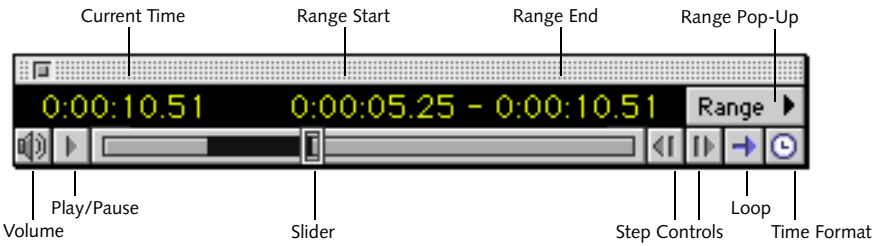


Figure A.6 The Movie Controller

- Select the volume icon to display a volume control slider.
- Select the play/pause icon to play or pause the movie.
- Drag the slider to set the current time of the movie. Shift-drag the slider to select a range of time values.
- Click the step controls to step backward or forward through the movie one frame at a time.
- Select the loop control to toggle between "play once" and "looped" play modes.
- Select the time format control to toggle the display of time between "time value" and "hour:minute:second:hundredths" mode.
- The Range pop-up can be used to select previously-defined ranges or specify new ones. Select "New Range" to display the New Range dialog (see "New Range" on page A.309). If a range of times has been selected by Shift-dragging the slider, those values will be shown as the defaults in the New Range dialog.

Ranges

Select this menu to show and hide the Ranges window (Figure A.7). The Ranges window lists any previously-defined ranges by name, start time value, and end time value. Double-click on a range name to display the Time Range dialog (Figure A.1), which can be used to change the name, start time, and end time of the selected range.

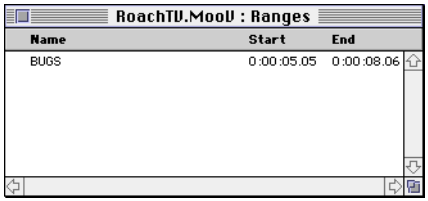


Figure A.7 The Ranges dialog

WINDOW MENU

The Window menu lists the names of all open MovieTrax windows. The current window is indicated with a checkmark. Select any window name from the menu to make that window the current one. The selected window moves to the "front" of the screen.

Index

Symbols

A

B

C

D

E

F

G

M

N

O

P

S

T

U

V

W

Z